The 22nd EURL-AR Proficiency Test - Enterococci, Staphylococci and E. coli 2017

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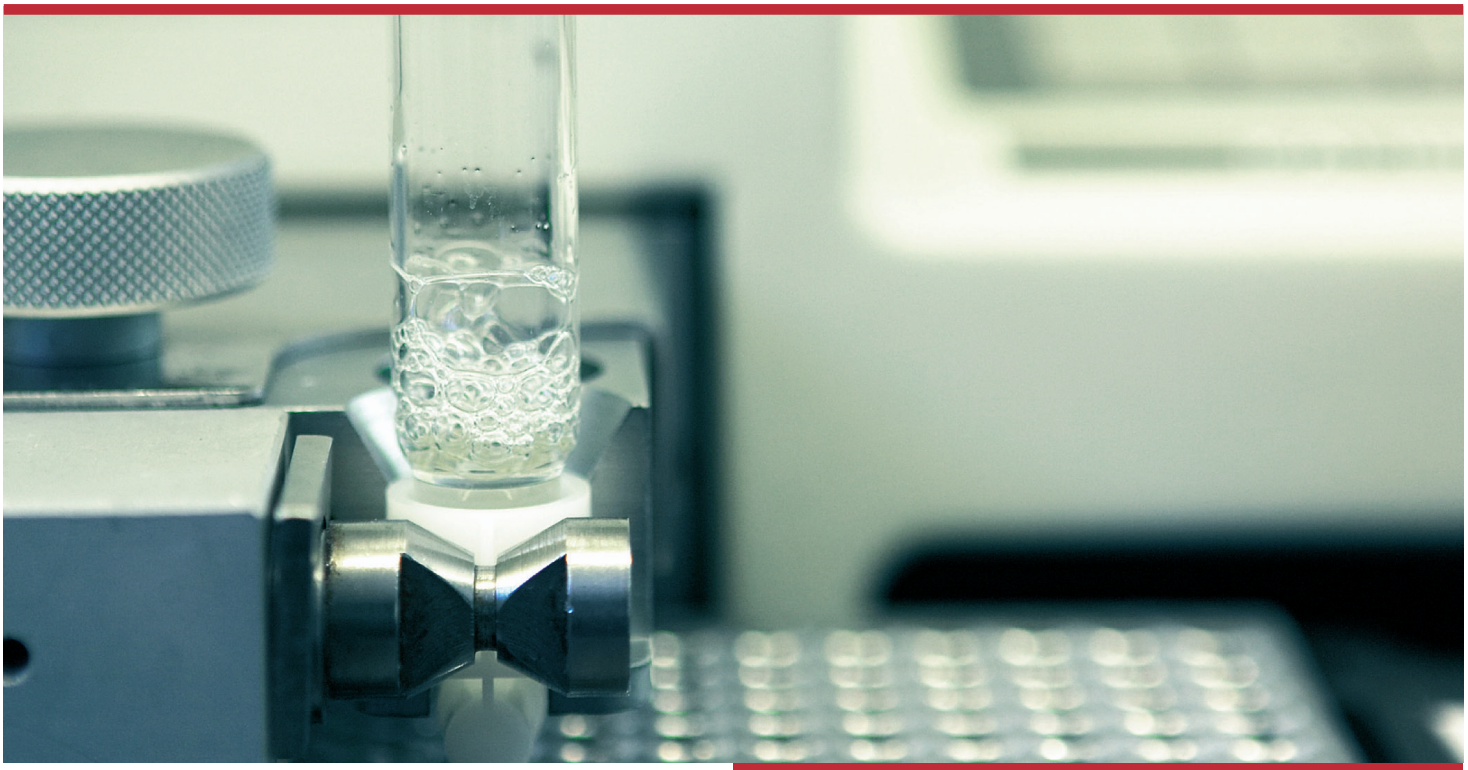

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The 22nd EURL-AR Proficiency Test Enterococci, Staphylococci and *Escherichia coli* - 2017

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1. Introduction

This report describes the results of the 22nd proficiency test organised by the Technical University of Denmark, National Food Institute (DTU-FOOD) as the EU Reference Laboratory for Antimicrobial Resistance (EURL-AR). This proficiency test focuses on antimicrobial susceptibility testing (AST) of enterococci, staphylococci and *Escherichia coli.* It is the 11th External Quality Assurance System (EQAS) conducted for AST of these microorganisms.

The aim of this EQAS is to: i) monitor the quality of AST results produced by National Reference Laboratories (NRL-AR), ii) identify laboratories which may need assistance to improve their performance in AST, and iii) determine possible topics for future research and collaboration.

When reading this report, please consider:

1) Expected results were generated by performing Minimum Inhibitory Concentration (MIC) determination on two occasions at DTU-FOOD. These results were verified by the United States Food and Drug Administration (FDA), Centre for Veterinary Medicine. Finally, MIC determination was performed at DTU-FOOD after preparation of the agar stab cultures to be shipped to participants to confirm that the vials contained the correct strains with the expected MIC values.

2) The evaluation is based on interpretation of MIC values obtained in agreement with i) the method reported in Decision 2013/652/EU, for testing of *E. coli* and enterococci; and ii) the most recent recommendations from EFSA, for testing of staphylococci (EFSA, 2012). Participants were requested to apply the same method used when generating AST results to be reported to EFSA. This request was made to ensure compliance with the main objective of this EQAS "to assess and improve the comparability of antimicrobial susceptibility data reported to EFSA by the different NRLs", as stated in the protocol (Appendix 4).

3) Only results obtained by MIC determination methods were allowed in this EQAS to comply with Decision 2013/652/EU. Thus, the set-up of the database for reporting results did not allow upload of disk diffusion results.

4) Laboratory performance is considered acceptable if there are < 5% deviations from expected results, as previously agreed by the EURL-AR network.

Evaluation of a result as "deviating from the expected interpretation" should be carefully analysed in a self-evaluation procedure performed by individual participants when the EQAS results are disclosed. MIC determination methods have limitations in reproducibility. Thus, on repeated testing, the same strain/antimicrobial combination can result in two MIC values differing by one-fold dilution. If the expected MIC is close to the breakpoint value for categorising the strain as susceptible or resistant, a one-fold dilution difference may result in different interpretations. Since this report evaluates the interpretations of MIC values, some participants may find their results classified as wrong even though the actual MIC measured is only one-fold dilution different from the expected MIC. In these cases (hereafter defined "one-fold dilution issues"), the participants should be confident about the good quality of their AST performance. At the EURL-AR, we strive to select test strains with MIC values distant from the breakpoints for resistance to avoid these ambiguous situations, though this is not always feasible for all strains and antimicrobial combinations. For this reason, the EURL-AR network unanimously established in 2008 that, if there are less than 75% correct results for a specific strain/antimicrobial combination, these results may be subtracted

from the evaluation report after a case by case evaluation to be detailed in the report.

This report is approved in its final version by a technical advisory group composed by competent representatives from all NRLs who meet yearly at the EURL-AR workshop.

All conclusions presented in this report are publicly available. However, participating laboratories are identified by codes and each code is known only to the corresponding laboratory. The full list of laboratory codes is confidential information known only by relevant representatives of the EURL-AR and the EU Commission.

The EURL-AR is accredited by DANAK as provider of proficiency testing (accreditation no. 516); working with zoonotic pathogens and indicator organisms as bacterial isolates (identification, serotyping and antimicrobial susceptibility testing).

2. Materials and Methods

2.1 Participants in EQAS 2017

A pre-notification to announce the EQAS 2017 on AST of enterococci, staphylococci and *E. coli* (Appendix 1) was sent by e-mail on the 9th March 2017 to the designated NRL-AR in the network and to ten additional laboratories in Denmark, Iceland, Israel, Norway, Serbia, Spain, Switzerland, the Netherlands, Turkey and United Kingdom invited to participate based on participation to previous EQAS iterations and/or affiliation to the EU network.

Participating laboratories represented all 28 EU Member States (MS) and three non-MS (Iceland, Norway, and Switzerland; Appendix 2 and Figure 1). Only one set of data per MS is included in this report.

2.2 Strains

The eight enterococci, eight staphylococci and eight *E. coli* included in this EQAS were selected among the DTU-FOOD strain collection based on available MIC data. For quality assurance purposes, one strain per each bacterial species has been included in all EQAS iterations performed to date to represent

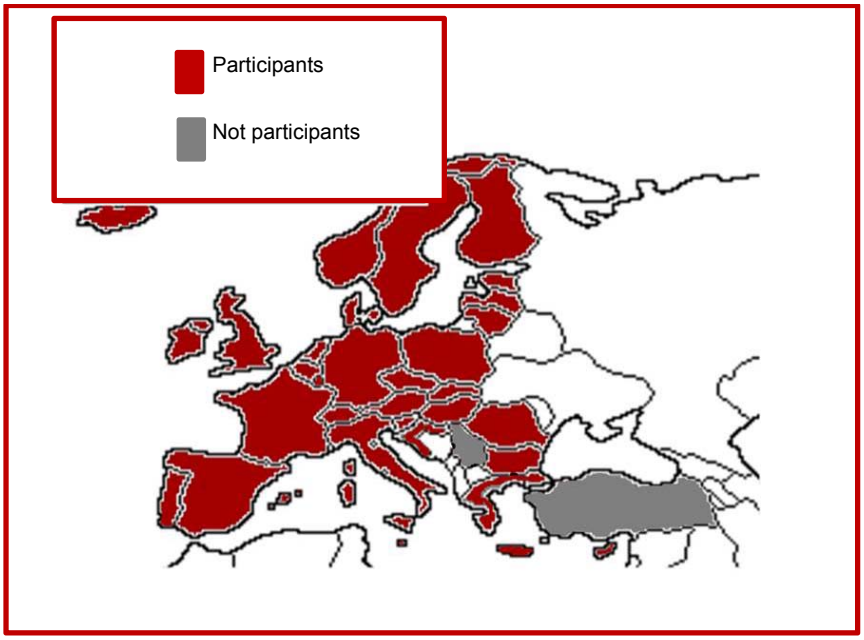

Figure 1. Countries participating in the EURL-AR EQAS on antimicrobial susceptibility testing of enterococci, staphylococci and/or *Escherichia coli*, 2017

Table 1. Panels of antimicrobials for antimicrobial susceptibility testing included in this EURL-AR EQAS 2017 component

Enterococci	Staphylococci	*Escherichia coli* 1st panel	*Escherichia coli* 2nd panel
Ampicillin, AMP	Cefoxitin, FOX	Ampicillin, AMP	Cefepime, FEP
Chloramphenicol, CHL	Chloramphenicol, CHL	Azithromycin, AZI	Cefotaxime + clavulanic acid (F/C)
Ciprofloxacin, CIP	Ciprofloxacin, CIP	Cefotaxime, FOT	Cefotaxime, FOT
Daptomycin, DAP	Clindamycin, CLN	Ceftazidime, TAZ	Cefoxitin, FOX
Erythromycin, ERY	Erythromycin, ERY	Chloramphenicol, CHL	Ceftazidime, TAZ
Gentamicin, GEN	Gentamicin, GEN	Ciprofloxacin, CIP	Ceftazidime+ clavulanic acid (T/C)
Linezolid, LZD	Linezolid, LZD	Colistin, COL	Ertapenem, ETP
Quinupristin-dalfopristin (Synercid), SYN	Mupirocin, MUP	Gentamicin, GEN	Imipenem, IMI
Teicoplanin, TEI	Quinupristin-dalfopristin (Synercid), SYN	Meropenem, MERO	Meropenem, MERO
Tetracycline, TET	Sulfamethoxazole, SMX	Nalidixic acid, NAL	Temocillin, TRM
Tigecycline, TGC	Sulfamethoxazole+Trimethoprim, SXT	Sulfamethoxazole, SMX	
Vancomycin, VAN	Tetracycline, TET	Tetracycline, TET	
	Tiamulin, TIA	Tigecycline, TGC	
	Trimethoprim, TMP	Trimethoprim, TMP	
	Vancomycin, VAN		

an internal control.

Expected MIC values (Appendix 3) for this EQAS were generated by using Sensititre panels (Trek Diagnostic Systems) at DTU-FOOD and further verified by the U.S. FDA. Results could not be verified by FDA for: ampicillin and teicoplanin (enterococci); colistin, ertapenem, meropenem, temocillin, trimethoprim and tigecycline (*E. coli*); and cefoxitin, clindamycin, mupirocin, sulfamethoxazole, sulfamethoxazole-trimethoprim, tiamulin and trimethoprim (staphylococci). MICs were further determined at DTU-FOOD after production of agar stab cultures to confirm expected values prior to shipment and to ensure homogeneity of the test cultures.

Reference strains *Enterococcus faecalis* ATCC 29212, *Staphylococcus aureus* ATCC 29213 and *E. coli* ATCC 25922 were provided to new participants with instructions to store and maintain them for quality assurance purposes and future EQAS trials. The expected quality control ranges for the reference strains were retrieved from Clinical and Laboratory Standards Institute (CLSI) in documents VET01 A4 (2013) / M100-S27 (2016) (App. 5).

2.3 Antimicrobials

The panels of antimicrobials recommended for AST in this trial are listed in Table 1.

These antimicrobials represent those defined by the Commission Implementing Decision 2013/652/EU for *E. coli* and enterococci, and those most recently recommended by EFSA for staphylococci.

2.4 Distribution

The bacterial strains were dispatched as agar

stab cultures on 21st June 2017. These bacterial cultures were shipped in double pack containers (class UN 6.2) as UN3373, biological substances category B according to the International Air Transport Association (IATA) regulations.

2.5 Procedure

The participants were recommended to keep the agar stab cultures refrigerated until performance of AST. Protocols and all relevant information were uploaded on the EURL-AR website (http://www.eurl-ar.eu) thus being available at any time (Appendix 4). Guidelines for performing AST were set according to the CLSI document – M7-A10 (2015) "Methods for Dilution Antimicrobial Susceptibility Tests for Bacteria That Grow Aerobically; Approved Standard - 10th Edition". Manufacturer's guidelines had to be followed when commercial methods were used.

Instructions for interpretation of AST results adhered to those specified in the Commission Implementing Decision 2013/652/EU, and were provided in the protocol (Appendix 4b: Tables 1, 2 and 3). Participants were invited to categorise the strains as resistant or susceptible using EUCAST epidemiological cut-off (ECOFF) values (www.eucast.org). For interpretation of the results of the *E. coli* 2nd panel (to be tested when a strain displayed resistance to cefotaxime, ceftazidime and/or meropenem in the *E. coli* 1st panel) participants were invited to adhere to recommendations by EFSA (Appendix 4b).

The EURL-AR is aware that there are two types of criteria for interpretation of MIC results: clinical breakpoints and ECOFF values. The terms 'susceptible', 'intermediate' and 'resistant' should be used for classification made in relation to the therapeutic application of antimicrobial agents, whereas bacteria should be reported as 'wild-type' or 'non-wild-type' when reporting data relative to ECOFF values (Schwarz et al., 2010). To simplify the interpretation of results, we maintain the terms susceptible and resistant throughout this report even when referring to wild-type and non-wild-type strains.

All participants were invited to enter the obtained results into an electronic record sheet at the EURL-AR web-based database designed for this trial. Participants were also encouraged to complete an evaluation form available on the EURL-AR database with the aim to improve future EQAS trials.

The database could be accessed through a secured individual login and password.

The database was closed on 15th September 2017.

After this date, the participants were invited to login again to retrieve an individual database-generated evaluation report.

3. Results and Discussion

In this report, results from 27, 27 and 31 laboratories for enterococci, staphylococci and *E. coli* were evaluated, respectively. The participants were invited to report MIC values and categorisation as resistant or susceptible for each strain/antimicrobial combination. Only the categorisation was evaluated, whereas the MIC values were used as supplementary information.

3.1 Results excluded from the report

The following strain/antimicrobial combinations resulted in ≥ 25% deviations from expected results: ENT-11.5/AMP, ENT-11.8/CHL, ST-11.2/SXT, ST-11.3/SXT, ST-11.6/CIP, ST-

11.6/SXT, ST-11.7/SXT, ST-11.8/SXT, EC-11.7/FEP, EC-11.8/CHL. In agreement with the decision by the EURL-AR network these results were carefully evaluated as reported in the table below.

Table 2. Strain/antimicrobial combinations yielding ≥25% deviations from expected results

Strain/Antimicrobial	Expected MIC/int.[1]	Agree[2]	Disagree[3]
ENT-11.5/AMP	8/R	6	18
ENT-11.8/CHL	64/R	17	9
ST-11.2/SXT	0.5/S	0	4
ST-11.3/SXT	0.5/S	0	3
ST-11.6/CIP	2/R	14	8
ST-11.6/SXT	0.25/S	3	1
ST-11.7/SXT	0.5/S	2	2
ST-11.8/SXT	0.25/S	3	1
EC-11.7/FEP	0.12/S	11	13
EC-11.8/CHL	16/S	17	12

AMP, ampicillin; CHL, chloramphenicol; CIP, ciprofloxacin; FEP, cefepime; SXT, sulfamethoxazole-trimethoprim.
[1]int., interpretation; [2]Number of labs with expected MIC and interpretation; [3]Number of labs with acceptable MIC but leading to interpretation different from that expected

All results regarding the strain/antimicrobial combinations reported in Table 2 were excluded from the report as they mostly represented deviations caused by “one-fold dilution issues” that cannot be considered representative of the ability of the laboratories to perform AST.

3.2 Overall performance

The percentage of results in agreement with those expected ranged from 96.7% (strain ENT-11.8) to 100% (strain ENT-11.1) (Table 3). The staphylococci trial yielded the highest percentage of correct results (99.1%), tightly followed by the *E. coli* trial (98.9%) and by the enterococci trial (98.1%).
The percentage of deviations from the expected results appears to be low (below 2%) and stable, with only minor fluctuations, for *E. coli* since 2012, for enterococci since 2013, and for staphylococci since 2014 (Figure 2). The results for the internal control strains appear to be stable for enterococci and *E. coli* since 2014, and for staphylococci since 2016 (Figure 2).
The list of deviations is reported in Appendices 8a, 8b and 8c.

Table 3. Total number (No.) and percentage (%) of antimicrobial susceptibility tests (AST) performed and in agreement with expected (correct) in the EURL-AR EQAS 2017

Strain	No. AST	No. correct	% correct	Strain	No. AST	No. correct	% correct	Strain	No. AST	No. correct	% correct
ENT-11.1	312	312	100,0	ST-11.1	360	357	99,2	EC-11.1	651	649	99,7
ENT-11.2	295	293	99,3	ST-11.2	353	351	99,4	EC-11.2	434	431	99,3
ENT-11.3	295	294	99,7	ST-11.3	355	350	98,6	EC-11.3	650	644	99,1
ENT-11.4	312	311	99,7	ST-11.4	357	354	99,2	EC-11.4	433	432	99,8
ENT-11.5	286	282	98,6	ST-11.5	351	349	99,4	EC-11.5	650	649	99,8
ENT-11.6	312	309	99,0	ST-11.6	332	328	98,8	EC-11.6	434	428	98,6
ENT-11.7	311	305	98,1	ST-11.7	354	351	99,2	EC-11.7	620	606	97,7
ENT-11.8	269	260	96,7	ST-11.8	357	353	98,9	EC-11.8	618	600	97,1

*ENT, enterococci; ST, staphylococci; EC, *Escherichia coli*.

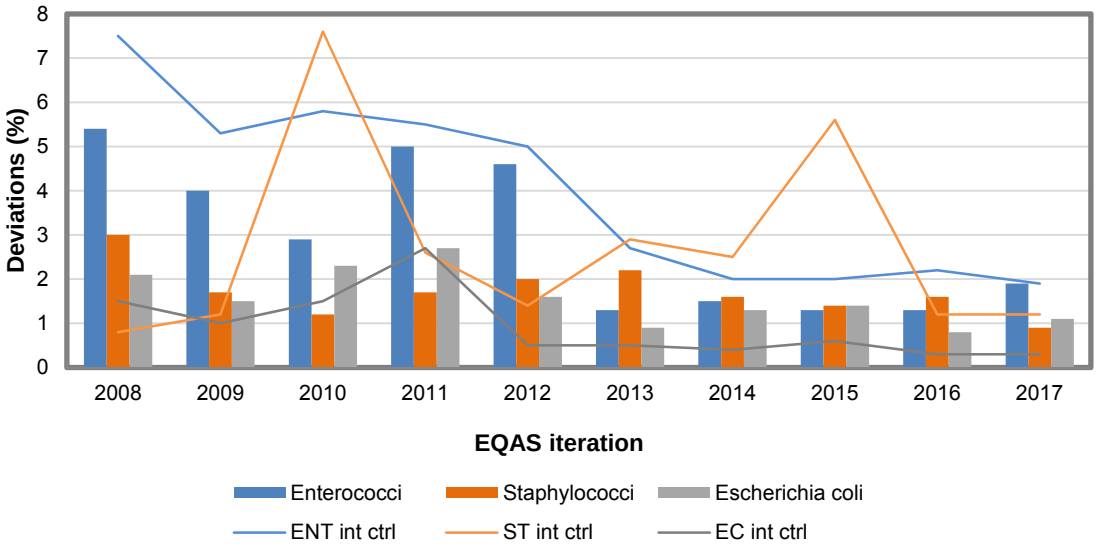

Figure 2. Overall deviations (%) from expected results by EQAS iteration. ENT, enterococci; ST, staphylococci; EC, *Escherichia coli*; int ctrl, internal control.

3.2.1 Enterococci

Twenty-seven laboratories (from 24 MS and three non-EU countries) approved results for the enterococci trial.

Strain-based analysis

No results deviating from those expected were observed for ENT-11.1. For the remaining strains, deviations ranged from 0.3% (n=1) for ENT-11.3 to 3.3% (n=9) for ENT-11.8 (Figure 3). For ENT-11.2, ENT-11.4 and ENT-11.5,

100%, 100% and 75% deviations (n=2, n=1 and n=3, respectively), respectively, were "one-fold dilution issues", whereas for ENT-11.6, ENT-11.7 and ENT-11.8, 67%, deviations for each strain (n=2, n=4 and n=6, respectively), represented true performance problems.

Antimicrobial-based analysis

Deviations from expected results were obtained for all antimicrobials except tetracycline (Figure 4). The antimicrobials that resulted in highest percentages of deviations were quinupristin-dalfopristin (3.3 %), erythromycin (1.8 %), and chloramphenicol (1.6 %). For quinupristin-dalfopristin, five deviations were obtained out of 150 uploaded results. Most of these deviations (n=3, 60%) were "one-fold dilution issues" and thus not indicative of any performance problem. The remaining deviations (n=2, 40%) could indicate performance problems. For erythromycin, four deviations were obtained out of 216 uploaded results. Three (75%) of these deviations indicated potential technical problems, whereas the remaining deviation was due to different interpretation of a MIC value obtained as expected. For chloramphenicol, three deviations were obtained out of 189 uploaded results and all were indicative of performance problems. An overview of obtained and expected results is reported in Appendix 7a.

Laboratory-based analysis

Nineteen laboratories (70%) reported all results in agreement with those expected (Figure 5).

Six laboratories had between 1% and 3.3% deviations (Figure 5). Of these, four laboratories (Lab # 17, 20, 40 and 56) obtained deviations due to "one-fold dilution issues", thus indicating no problems in enterococci AST performance.

One laboratory (Lab # 45) obtained two deviations due to "one-fold dilution issue" and one deviation possibly indicating quinupristin/dalfopristin testing issues. The remaining laboratory (Lab #23) obtained on deviation possibly indicating erythromycin testing issues.

Two laboratories had percentages of deviations above the threshold for acceptable laboratory performance, which is set at 5 % (Figure 5).
Lab #21 had 11 (17.4%) deviations of which four (30%) were "one-fold dilution issues", whereas the remaining 7 (70%) were due to performance problems in five strains, and in particular all deviations consisted of interpretation as "R" of strains that were susceptible to chloramphenicol (n=3), ciprofloxacin (n=1), erythromycin (n=1), linezolid (n=1) and vancomycin (n=1).
Lab # 36 had five (5.4%) deviations all indicative of performance problems.

Deviations from expected results obtained by each participant in the enterococci trial are reported in Appendix 8a.

Enterococci species identification

Participants were requested to identify the enterococci species as a mandatory component. The test strains were three *E. faecalis* (ENT-11.2, ENT-11.3 and ENT-11.8) and five *E. faecium* (ENT-11.1, ENT-11.4, ENT-11.5, ENT-11.6 and ENT-11.7). Enterococci species identification results were uploaded by all participants for a total of 216 results. One (0.4%) result was in disagreement with the expected as one laboratory (Lab #36) reported ENT-11.8 as *E. faecium* instead of *E. faecalis*.

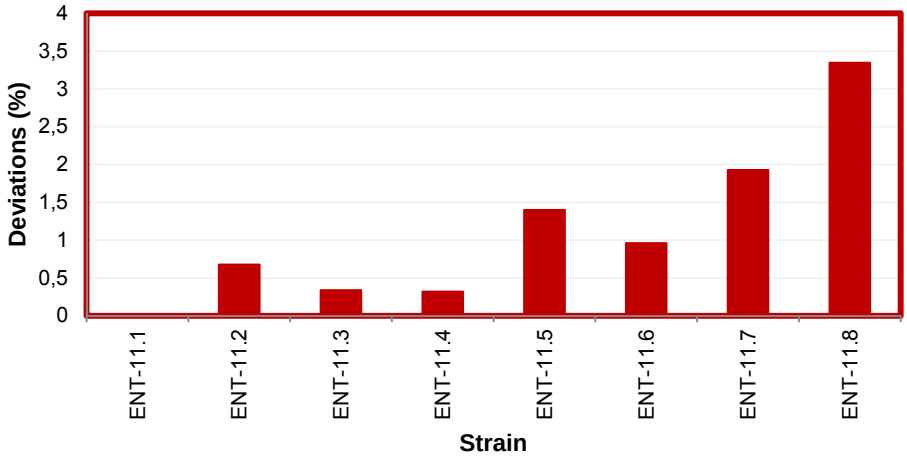

Figure 3. Deviations (%) from expected interpretation of AST result for each *Enterococcus* sp. strain, EURL-AR EQAS 2017.

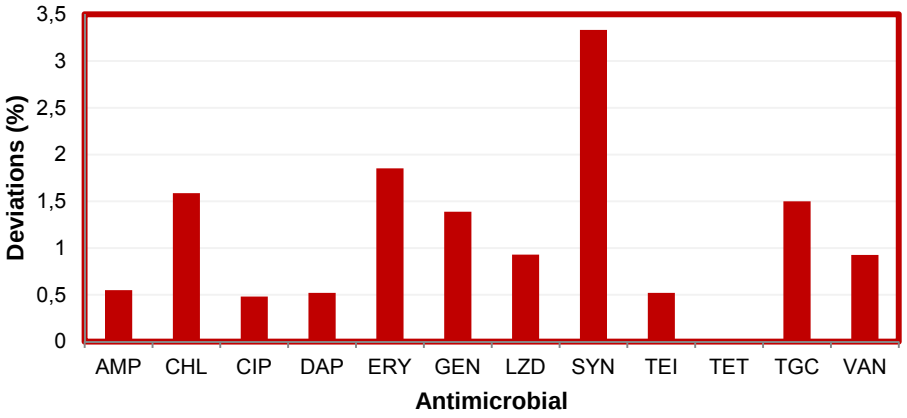

Figure 4. Deviations (%) from expected interpretation of AST results for each antimicrobial. Enterococci component of the EURL-AR EQAS 2017. AMP, ampicillin; CHL, chloramphenicol; CIP, ciprofloxacin; DAP, daptomycin; ERY, erythromycin; GEN, gentamicin; LZD, linezolid; SYN, quinupristin/dalfopristin (synercid); TEI, teicoplanin; TET, tetracycline; TGC, tigecycline; VAN, vancomycin.

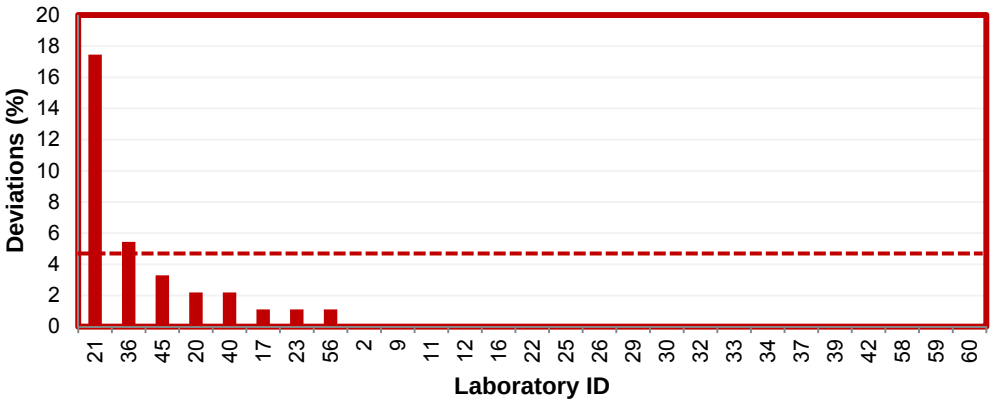

Figure 5. Deviations (%) by participating laboratory in the enterococci trial, EURL-AR EQAS 2017. The dashed line indicates the threshold (5%) for acceptable laboratory performance.

3.2.2 Staphylococci

Twenty-seven laboratories (from 24 MS and three non-MS) uploaded results for the staphylococci trial.

Strain-based analysis

Deviations ranged from 0.5% (n=2) in ST-11.2 and ST-11.5 to 1.4% (n=5) in ST-11.3 (Figure 6). For ST-11.3 and ST-11.8, 80% and 100% deviations, respectively (n=4 in both strains) represented "one-fold dilution issues". For strains ST-11.2, ST-11.5 and ST-11.6, 50% (n=1, n=1 and n=2, respectively) of the deviations were "one-fold dilution issues" and the remaining 50% indicated performance problems. For ST-11.1, ST-11.4 and ST-11.7, 100% deviations (n=3 in each strain) might represent performance problems.

Antimicrobial-based analysis

All (100%) results for ciprofloxacin, clindamycin, gentamicin, linezolid, tiamulin and vancomycin were in agreement with those expected (Figure 7). The antimicrobials that resulted in highest percentages of deviations were sulfamethoxazole-trimethoprim (9.5%), sulfamethoxazole (4%), and quinupristin-dalfopristin (3.1 %) (Figure 7). For sulfamethoxazole/trimethoprim, two deviations out of 21 reported results were observed and likely represented "one-fold dilution issues" and no performance problems. For sulfamethoxazole, 8 deviations out of 197 reported results were observed. All but one deviation consisted of expected susceptible strains (MIC ≤ 64 mg/L) classified as resistant (MIC > 512 mg/L), and thus highlighted problems in reading sulfamethoxazole MIC, which is notoriously difficult. As sulfamethoxazole is a bacteriostatic drug, often there is no clear bacterial inhibition and MIC should be set in the well showing less than 20% growth compared to that observed in the positive control wells. Thus, the reading may be highly subjective. For quinupristin-dalfopristin, six deviations out of 191 reported results were observed. Of these, three and two deviations were "one-fold dilution issues" and wrong interpretation of MIC obtained as expected, respectively. The remaining deviation indicated a technical performance problem.

An overview of obtained and expected results is reported in Appendix 7b.

Laboratory-based analysis

Sixteen laboratories (59%) reported all results in agreement with those expected (Figure 8).

Eleven laboratories obtained between 0.9% and 4.7% deviations (Figure 8). In six laboratories (Lab #12, 17, 22, 23, 31 and 59), all deviations obtained represented "one-fold dilution issues", thus indicating no problems in staphylococci AST performance. In two laboratories (Lab #40 and 45), most deviations, i.e. two (66.6%) and three (75%), respectively, indicated performance problems and in all cases the deviation was caused by defining as resistant to sulfamethoxazole and trimethoprim (Lab #40), and to quinupristin/dalfopristin and tetracycline (Lab #45), strains that were indeed susceptible. In the remaining three laboratories, all deviations indicated performance problems linked to sulfamethoxazole (Lab #11: one deviation, and lab #18: 5 deviations), and to chloramphenicol, erythromycin and mupirocin (Lab # 39: one deviations per each antimicrobial).

No laboratory obtained deviations above the threshold for acceptable laboratory performance (5%) (Figure 8).

Deviations from expected results obtained by each participant in the staphylococci trial are reported in Appendix 8b.

Methicillin-resistant *S. aureus*

Participants were requested to identify the presence/absence of methicillin resistance as a mandatory component. The test strains included six methicillin-resistant *S. aureus* (MRSA; ST-11.2, ST-11.3, ST-11.4, ST-11.5, ST-11.6 and ST-11.7) and two methicillin-susceptible *S. aureus* (MSSA; ST-11.1 and ST-11..8). All participants submitted MRSA/MSSA results. Four out of 216 (1.8%) results were in disagreement with those expected. This was caused by three participants (Lab #25, 39, 45) reporting strain ST-11.4 (MRSA, *mecC* positive) as MSSA and one participant reporting strain ST-11.7 (MRSA, *mecA* positive) as MSSA.

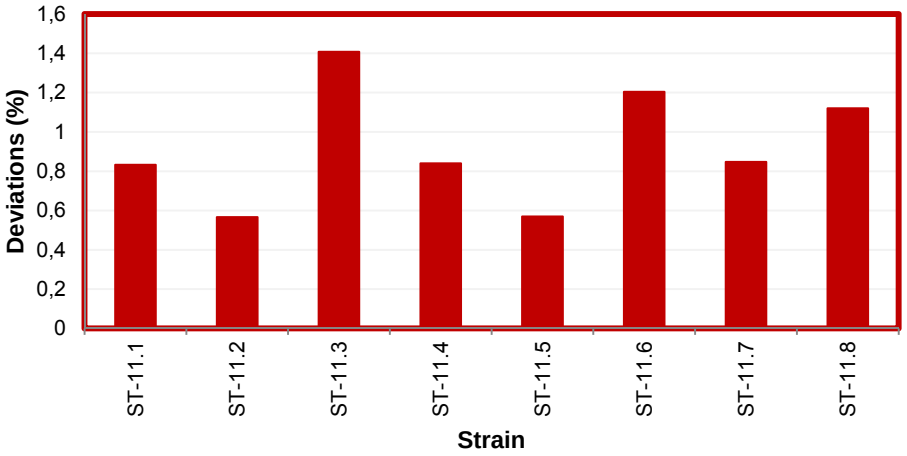

Figure 6. Deviations (%) from expected interpretation of AST results for each *Staphylococcus aureus* strain, EURL-AR EQAS 2017.

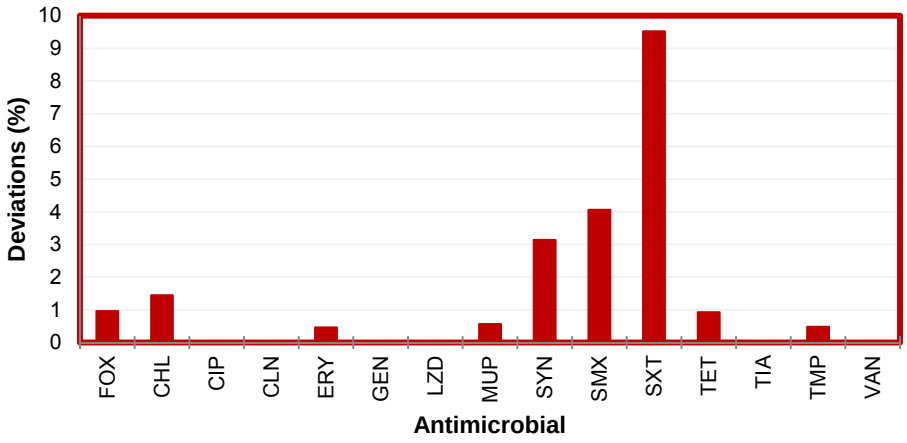

Figure 7. Deviations (%) from expected interpretation of AST results for each antimicrobial. *Staphylococcus aureus* component of the EURL-AR EQAS 2017. CHL, chloramphenicol; CIP, ciprofloxacin; CLN, clindamycin; ERY, erythromycin; FOX, cefoxitin; GEN, gentamicin; LZD, linezolid; MUP, mupirocin; SYN, quinupristin/dalfopristin (synercid); SMX, sulfamethoxazole; SXT, sulfamethoxazole-trimethoprim; TET, tetracycline; TIA, tiamulin; TMP, trimethoprim; VAN, vancomycin.

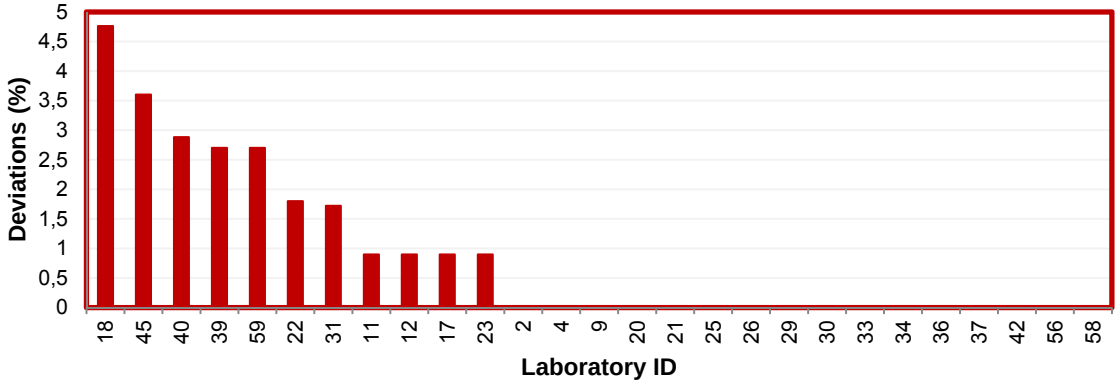

Figure 8. Deviations (%) by participating laboratory in the staphylococci trial, EURL-AR EQAS 2017. The threshold for acceptable laboratory performance is 5%.

3.2.3 *Escherichia coli*

Thirty-one laboratories (from 28 MS and three non-MS) uploaded results for the *E. coli* trial.

Strain-based analysis

Deviations ranged from 0.1% (n=2) for EC-11.5 to 2.9% (n=18) for EC-11.8 (Figure 9). For EC-11.3 and EC-11.6, all deviations (n=6 for both strains) were "one-fold dilution issues" and different interpretation of MIC values obtained as expected, thus no technical problems were observed in AST of these strains. For EC-11.1, EC-11.7 and EC-11.8, 50%, 93% and 61% (n=1, n=13, and n=11, respectively) deviations, respectively, indicated performance problems whereas the remaining deviations were "one-fold dilution issues". For EC-11.2, EC-11.4 and EC-11.5, all deviations (n=3, n=1 and n=1, respectively) indicated performance problems.

Antimicrobial-based analysis

No deviations from expected results were obtained when testing susceptibility to gentamicin, tigecycline and trimethoprim (Figure 10). The antimicrobials that resulted in highest percentages of deviations were imipenem (4.5%), nalidixic acid (4.4%), and azithromycin and colistin (both with 2.4% deviations) (Figure 10). For imipenem, seven deviations were observed out of 154 uploaded results, and all deviations indicated performance issues. For nalidixic acid, eleven deviations were observed out of 247 uploaded results. Two (18%) of such deviations indicated performance issues, whereas the remaining deviations were "one-fold dilution issues". For azithromycin, six deviations were observed out of 248 uploaded results. Four (66%) of such deviations indicated performance issues, whereas the remaining deviations were "one-fold dilution issues". Also for colistin six deviations were observed out of 248 uploaded results, but all deviations were "one-fold dilution issues".

An overview of obtained and expected results is reported in Appendix 7c.

Laboratory-based analysis

Fifteen laboratories (48.4%) reported all results in agreement with those expected (Figure 11).

Seven laboratories (22.6%) had 0.6% deviation representing one deviation per laboratory. All these deviations were "one-fold dilution issues", thus no performance issues were identified also in Lab # 2, 19, 21, 32, 40, 56 and 59.

Four laboratories (13%) obtained 1.3% deviations representing two deviations per laboratory. Both lab #17 and #37, had one deviation due to "one-fold dilution issues" and the other due to different interpretation of MIC values obtained as expected. In Lab # 39, one deviation was due to "one-fold dilution issue" and the other could indicate a performance problem. For Lab #4 both deviations indicated performance problems.

Three laboratories (9.6%) obtained three deviations each. For Lab #45 and Lab #20, all and most (66%) deviations were "one-fold dilution issues", respectively. For Lab #22, all deviations indicated performance issues.

Two laboratories (6.4%) had a percentage of deviations above the threshold for acceptable laboratory performance (5%). Lab #26 had 6.8% deviations of which 30% (n=3) represented "one-fold dilution issues", whereas the remaining indicated performance problems in testing a few antimicrobials in five strains. In particular, problems in carbapenem susceptibility testing were observed for three strains. Lab #42 had 11.7% (n=17) deviations in two strains that likely represent a strain management issue as it appeared that results for these two strains were swapped.

Deviations from expected results obtained by each participant in the *E. coli* trial are reported in Appendix 8c.

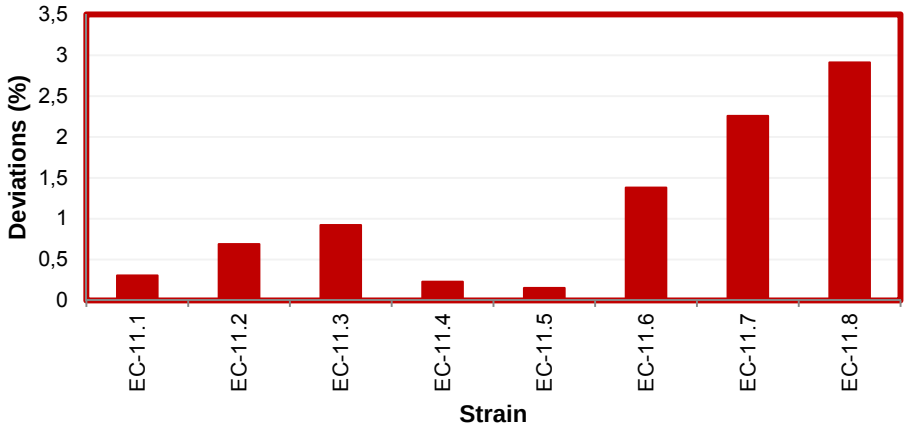

Figure 9. Deviations (%) from expected interpretation of AST results for each *Escherichia coli* strain, EURL-AR EQAS 2017

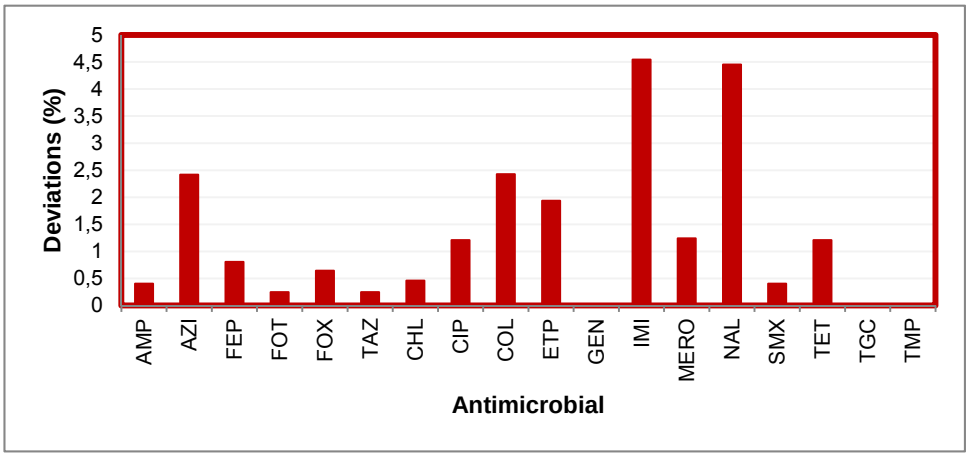

Figure 10. Deviations (%) from expected interpretation of AST results for each antimicrobial. *Escherichia coli* component of the EURL-AR EQAS 2017. AMP, ampicillin; AZI, azithromycin; FEP, cefepime; FOT, cefotaxime; TAZ, ceftazidime; CHL, chloramphenicol; CIP, ciprofloxacin; COL, colistin; ETP, ertapenem; GEN, gentamicin; IMI, imipenem; MERO, meropenem; NAL, nalidixic acid; SMX, sulfamethoxazole; TET, tetracycline; TGC, tigecycline; TMP, trimethoprim.

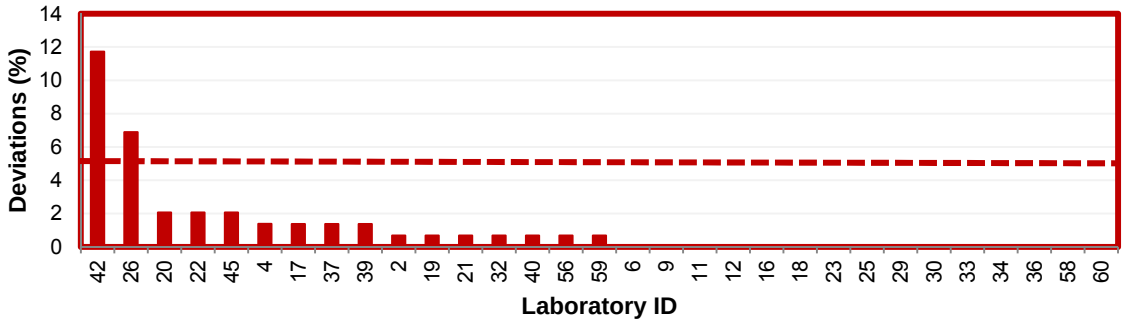

Figure 11. Deviations (%) by participating laboratory in the *Escherichia coli* trial, EURL-AR EQAS 2017. The dashed line indicates the threshold (5%) for acceptable laboratory performance

Beta-lactamase-producing *E. coli*

Participants were requested to detect the production of beta-lactamases and classify the beta-lactam resistance phenotype into Extended-Spectrum Beta-Lactamase (ESBL)/AmpC/carbapenemase production as a mandatory component.

Guidelines for interpretation of the beta-lactam resistance phenotype were specified in the protocol (Appendix 4b) and were in agreement with the latest recommendations by EFSA.

In this EQAS, EC-11.1 and EC-11.3 were ESBL producers; EC-11.7 was an AmpC beta-lactamase producer, and EC-11.5 and EC-11.8 were carbapenemase producers. The remaining strains (EC-11.2, EC-11.4 and EC-11.6) did not produce any beta-lactamase.

All 31 participants uploaded results for this part of the *E. coli* trial. Except for on laboratory (Lab #22) identifying EC-11.2 as an ESBL whereas the expected result was no ESBL/AmpC/carbapenemase, no wrong detection of ESBL/AmpC/carbapenemase-producing *E. coli* was observed (Table 4). However, seven cases of misclassification (Table 4) were observed in five laboratories indicating some difficulties in classification of beta-lactam resistance phenotypes.

Strain code		EC-11.1	EC-11.2	EC-11.3	EC-11.5	EC-11.7	EC-11.8
Expected results		ESBL	Not relevant/ Susceptible	ESBL	Carbapenemase	AmpC	Carbapenemase
Obtained results	ESBL	31/31 (100%)	1/31 (3.2%)	31/31 (100%)			
	AmpC					27/31 (87.2%)	1/31 (3.2%)
	ESBL + AmpC					2/31 (6.4%)	
	Carbapenemase				30/31 (96.7%)	1/31 (3.2%)	29/31 (93.6%)
	Other				1/31 (3.2%)	1/31 (3.2%)	1/31 (3.2%)
	Susceptible		30/31 (96.7%)				
Genetic background		*bla*$_{CTX-M-1}$	no beta-lactam resistance gene detected	*bla*$_{TEM-52}$	*bla*$_{NDM-1}$	chromosomal *ampC* promoter mutation (-42 and -18)	*bla*$_{KPC-2}$

Table 4. Expected and obtained classification of beta-lactam resistance phenotype and genetic background of each *Escherichia coli* strain, EURL-AR EQAS 2017.

3.3 Performance in AST of the quality control strains

Antimicrobial susceptibility test results for the quality control strains were evaluated based on the CLSI quality control ranges (Appendix 5).

3.3.1 *Enterococcus faecalis* ATCC 29212

All 27 participants in the enterococci trial performed AST of *E. faecalis* ATCC 29212 by MIC determination reporting a total of 287 test results, of which 98.9% were within the acceptable range (Table 5). The deviationfor tigecycline was obtained by Lab #45, whereas the deviations for daptomycin and linezolid were obtained by Lab #59.

Table 5. Antimicrobial susceptibility testing of *Enterococcus faecalis* ATCC 29212 by MIC determination

Antimicrobial	Proportion outside of range	Below acceptable range	Above acceptable range
Ampicillin	0/26 (0%)	–	–
Chloramphenicol	0/27 (0%)	–	–
Ciprofloxacin	0/26 (0%)	–	
Daptomycin	1/23 (4.3	1	
Erythromycin	0/27 (0%)	–	–
Gentamicin	0/27 (0%)	–	–
Linezolid	1/27 (3.7%)	1	–
Quinu/dalfopristin	0/0	–	–
Teicoplanin	0/24 (0%)	–	–
Tetracycline	0/27 (0%)	–	–
Tigecycline	1/25 (4%)	–	1
Vancomycin	0/27 (0%)	–	–

3.3.2 *Staphylococcus aureus* ATCC 29213

All 27 participants in the staphylococci trial performed AST of *S. aureus* ATCC 29213 by MIC determination reporting a total of 312 test results, of which 99% were within the acceptable range (Table 6). The deviations for sulfamethoxazole were obtained by Lab #18 (above acceptable range) and by Lab #37 (below acceptable value). Lab #37 also had a deviation for trimethoprim.

Table 6. Antimicrobial susceptibility testing of *Staphylococcus aureus* ATCC 29213 by MIC determination

Antimicrobial	Proportion outside of range	Below acceptable range	Above acceptable range
Cefoxitin	0/26 (0%)	–	–
Chloramphenicol	0/26 (0%)	–	–
Ciprofloxacin	0/26 (0%)	–	–
Clindamycin	0/26 (0%)	–	–
Erythromycin	0/27 (0%)	–	–
Gentamicin	0/26 (0%)	–	–
Linezolid	0/25 (0%)	–	–
Mupirocin	no range	–	–
Quinu/dalfopristin	0/23 (0%)	–	–
Sulfamethoxazole	2/23 (8.6%)	1	1
Sulfa/Trimethoprim	0/4 (0%)	–	–
Tetracycline	0/27 (0%)	–	–
Tiamulin	no range	–	–
Trimethoprim	1/26 (3.8%)	1	–
Vancomycin	0/25 (0%)	–	–

3.3.3 *Escherichia coli* ATCC 25922

All 31 participants in the *E. coli* trial tested *E. coli* ATCC 25922 by MIC determination reporting a total of 591 test results, of which 99% were within the acceptable range (Table 7). The deviations for sulfamethoxazole were obtained by Lab #4, #26 and #59, whereas the deviations for trimethoprim were obtained by Lab # 29 and #60.

Further details on test results of quality control strains are reported in Appendix 6.

Table 7. Antimicrobial susceptibility testing of *Escherichia coli* ATCC 25922 by MIC determination.

Antimicrobial	Proportion outside of range	Below accept. range	Above accept. range
Ampicillin	0/31 (0%)	–	–
Azithromycin	no range	–	–
Cefotaxime	0/57 (0%)	–	–
Ceftazidime	0/58 (0%)	–	–
Chloramphenicol	0/31 (0%)	–	–
Ciprofloxacin	0/31 (0%)	–	–
Colistin	0/31 (0%)	–	–
Gentamicin	0/31 (0%)	–	–
Meropenem	0/58 (0%)	–	–
Nalidixic acid	0/31 (0%)	–	–
Sulfamethoxazole	3/31 (9.6%)	–	3
Tetracycline	0/31 (0%)	–	–
Tigecycline	0/31 (0%)	–	–
Trimethoprim	2/31 (6.4%)	2	–
Cefepime	0/27 (0%)	–	–
Cefotaxime/clavulanic acid	no range	–	–
Cefoxitin	0/27 (0%)	–	–
Ceftazidime/clavulanic acid	no range	–	–
Ertapenem	0/27 (0%)	–	–
Imipenem	0/27 (0%)	–	–
Temocillin	no range	–	–

4. Conclusions

This report presented the result of the EURL-AR EQAS 2017 for *E. coli*, enterococci and staphylococci. This proficiency test evaluated the performance in i) MIC determination and interpretation, ii) enterococci species identification and iii) detection of relevant phenotypes such as methicillin resistance in *S. aureus* and beta-lactam resistance mediated by ESBL/AmpC/carbapenemase in *E. coli*.

Participants invited to this EQAS represent NRL-AR from each EU MS and additional laboratories affiliated to the EURL-AR network including laboratories from non-MS and laboratories other than NRL-AR in MS.

Results from NRL-AR and from one laboratory per non-MS were analysed in this report, leading to a total of 27 (24 MS and 3 non-MS), 27 (24 MS and 3 non-MS) and 31 (28 MS and 3 non-MS) sets of results analysed for enterococci, staphylococci and *E. coli*, respectively.

In the MIC determination and interpretation component, two, none and two laboratories obtained more than 5% deviations in the enterococci, staphylococci and *E. coli* trial, respectively. Communication between the EURL-AR and these underperforming laboratories is ongoing to assess the causes of the high percentages of deviations and to identify possible troubleshooting procedures.

Generally, a notable proportion of deviations was caused by expected MIC values close to breakpoint for resistance. Thus, a one-fold dilution difference from expected value, which is acceptable method variability, resulted in different interpretation and was scored as a deviation. This is not indicative of any performance problem. However, it was also possible to identify a few performance issues that could be addressed in a relatively easy way by the involved laboratories such as deviations due to different interpretation of MIC values that were obtained in agreement with those expected swap of strains. Notable deviations were those obtained in imipenem and colistin susceptibility testing in *E. coli*. As these antimicrobials are indicators of resistance phenotypes of public health relevance that are emerging in food-producing animals in Europe, it is critical for laboratories to be able to detect them correctly. Laboratories having issues in detecting these phenotypes are invited to contact the EURL-AR that will provide assistance for troubleshooting. Other notable deviations were those obtained in sulfamethoxazole and sulfamethoxazole-trimethoprim reading in staphylococci. As reading of sulfamethoxazole MIC often has a certain degree of subjectivity, the main possibility for improvement is to perform continuous training in MIC reading and for example use the opportunity of the MIC reading surveys performed by the EURL-AR. Deviations for

Enterococci species identification was performed correctly by all laboratories except one that reported incorrect identification for only one of the test strains. Thus the results are satisfactory but can still be improved.

Detection of methicillin resistance in *S. aureus* was correctly performed by all laboratories except four that could not identify methicillin resistance in one of the six MRSA strains provided. In particular, the *mecC* MRSA proved to be the most problematic to detect as three laboratories reported it as MSSA. As *mecC* MRSA is an emerging form of MRSA relevant to human and veterinary health, further efforts will be made to ensure that all laboratories are able to detect this phenotype.

Detection of ESBL/AmpC/carbapenemase production in *E. coli* was correctly performed by all laboratories except one that reported as ESBL a strain that was susceptible to cefotaxime and ceftazidime. Interpretation of the beta-lactam resistance phenotypes presented challenges for a few laboratories highlighting the need to further support the network in classification of the beta-lactam resistance phenotypes according to the EFSA guidelines.

Overall, performance in this EQAS was consistent with that observed in EQAS iterations since 2014 both regarding total percentage of deviations and number of laboratories with percentage of deviations above the acceptable limit. This implies that further efforts should be made to ensure excellent AST performance across all laboratories in the network.

As usual, the EURL-AR welcomes suggestions for improvement of future EQAS trials and invites the network to contribute with ideas for newsletters and for training needs, with the overall goal to continuously improve the knowledge and skills of the laboratories involved in the AMR monitoring.

5. References

European Food Safety Authority; Technical specifications on the harmonised monitoring and reporting of antimicrobial resistance in methicillin-resistant *Staphylococcus aureus* in food-producing animals and food. EFSA Journal 2012; 10(10):2897. [56 pp.] doi:10.2903/j.efsa.2012.2897. Available online: www.efsa.europa.eu/efsajournal

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Schwarz S, Silley P, Simjee S, Woodford N, van DE, Johnson AP & Gaastra W. (2010) Editorial: assessing the antimicrobial susceptibility of bacteria obtained from animals. J Antimicrob Chemother 65: 601-604.

Appendix 1

DTU Food
National Food Institute

G00-06-001/01.12.2014

EURL-AR EQAS pre-notification

EQAS 2017 FOR *E. COLI*, STAPHYLOCOCCI AND ENTEROCOCCI

The EURL-AR announces the launch of another EQAS, thus providing the opportunity for proficiency testing which is considered an essential tool for the generation of reliable laboratory results of consistently good quality.

This EQAS consists of antimicrobial susceptibility testing of eight *E. coli* isolates, eight staphylococci and eight enterococci isolates. Additionally, quality control (QC) strains *E. coli* ATCC 25922 (CCM 3954), *E. faecalis* ATCC 29212 (CCM 4224) and *S. aureus* ATCC 29213 (CCM 4223) (for MIC) will be distributed to new participants.

This EQAS is specifically for NRL's on antimicrobial resistance (NRL-AR). Laboratories designated to be NRL-AR do not need to sign-up to participate but are automatically regarded as participants. You may contact the EQAS-Coordinator if you wish to inform of changes in relation to your level of participation compared to previous years. The EURL-AR will be able to cover the expenses for one parcel, only, per EU Member State. Therefore, countries with more than one laboratory registered on the EURL-AR contact-list will be contacted directly to confirm which laboratory will be included for participation free of charge.

The invitation to participate in the proficiency test is extended to additional participants besides official NRLs and to participants from laboratories which are involved in the network but are not designated NRLs (cost for participation will be 100 euro).

TO AVOID DELAY IN SHIPPING THE ISOLATES TO YOUR LABORATORY
The content of the parcel is "UN3373, Biological Substance Category B. Eight *E. coli*, eight staphylococci, eight enterococci and for new participants also the QC strains mentioned above. Please provide the EQAS coordinator with documents or other information that can simplify customs procedures (e.g. specific text that should be written on the proforma invoice). To avoid delays, we kindly ask you to send this information already at this stage.

TIMELINE FOR RESULTS TO BE RETURNED TO THE NATIONAL FOOD INSTITUTE
Shipment of isolates and protocol: The isolates will be shipped in *June* 2017. The protocol for this proficiency test will be available for download from the website (www.eurl-ar.eu).

Submission of results: Results must be submitted to the National Food Institute **no later than *September, 8th, 2017***, via the password-protected website.
Upon reaching the deadline, each participating laboratory is kindly asked to enter the password-protected website once again to download an automatically generated evaluation report.

EQAS report: A report summarising and comparing results from all participants will be issued. In the report, laboratories will be presented coded, which ensures full anonymity. The EURL-AR and the EU Commission, only, will have access to un-coded results. The report will be publicly available.

Next EQAS: The next EURL-AR EQAS that we will have is on antimicrobial susceptibility testing of *Salmonella* and *Campylobacter* and a new EQAS on isolation of ESBL- and AmpC –producing *E. coli* from caeca and meat samples, which are both expected to be carried out in *October, 2017.*
Please contact me if you have comments or questions regarding the EQAS.

Sincerely,
Susanne Karlsmose Pedersen,
EURL-AR

Appendix 2

Participants in the EURL-AR EQAS 2017

Institute	Country	E. coli	Ent	Staph
Austrian Agency for Health and Food Safety	Austria	x	x	x
Institute of Public Health	Belgium	x	no	x
Nacional Diagnostic and Research Veterinary Institute	Bulgaria	x	x	x
Croatian Veterinary Institut	Croatia	x	x	x
Veterinary Services	Cyprus	x	no	no
State Veterinary Institute Praha	Czech Republic	x	x	x
National Food Institute	Denmark	x	x	x
Danish Veterinary and Food Administration, DVFA	Denmark	x	x	no
Estonian Veterinary and Food Laboratory	Estonia	x	x	x
Finnish Food Safety Authority EVIRA	Finland	x	x	x
Agence nationale de sécurité sanitaire ANSES - Fougères LERMVD	France	x	x	no
Federal Institute for Risk Assessment	Germany	x	x	x
Veterinary Laboratory of Chalkis	Greece	x	no	x
Central Agricultural Office Veterinary Diagnostic Directorate	Hungary	x	no	no
University of Iceland	Iceland	x	x	x
Central Veterinary Research Laboratory	Ireland	x	x	x
Ministry of Health	Israel	x	x	x
Istituto Zooprofilattico Sperimentale delle Regioni Lazio e Toscana	Italy	x	x	x
Institute of Food Safety, Animal Health and Enviroment "BIOR"	Latvia	x	x	x
National Food and Veterinary Risk Assessment Institute	Lithuania	x	x	x
Laboratoire national de Santé	Luxembourg	X	X	X
Public Health Laboratory	Malta	x	x	x
Central Veterinary Institute of Wageningen UR	Netherlands	x	x	x
Food and Consumer Product Safety Authority (VWA)	Netherlands	x	x	x
Veterinærinstituttet	Norway	x	x	x
National Veterinary Research Institute	Poland	x	x	x
Instituto Nacional de Investigação Agrária e Veterinária	Portugal	x	x	x
Institute for Hygiene and Veterinary Public Health	Romania	x	x	x
Institute for Diagnosis and Animal Health	Romania	x	x	x
State Veterinary and Food Institute (SVFI)	Slovakia	x	x	x
National Veterinary Institute	Slovenia	x	x	x
Laboratorio Central de Sanidad, Animal de Santa Fe	Spain	no	no	x
Laboratorio Central de Sanidad, Animal de Algete	Spain	x	x	no
VISAVET Health Surveillance Center, Complutense University	Spain	x	x	x
National Veterinary Institute, SVA	Sweden	x	x	x
Vetsuisse faculty Bern, Institute of veterinary bacteriology	Switzerland	x	x	x
The Veterinary Laboratory Agency	United Kingdom	x	x	x

Color code
NRLs_results evaluated in the report
non-NRL enrolled for EQAS or extra-NRL enrolled_results not evaluated in the report
NRL from non EU MS_results evaluated in the report

Appendix 3a

Expected MIC values

Strain ID	Species	Antimicrobial											
		DAP	TIG	TEI	AMP	CHL	CIP	ERY	GEN	LZD	Q-D	TET	VAN
EURL ENT 11.1	*Enterococcus faecium*	4	0.12	>64	<=0.5	8	4	<=1	16	2	4	64	>128
EURL ENT 11.2	*Enterococcus faecalis*	4	0.25	<=0.5	1	128	1	>128	1024	2	32	128	<=1
EURL ENT 11.3	*Enterococcus faecalis*	1	0.25	>64	1	128	>16	>128	>1024	2	4	64	>128
EURL ENT 11.4	*Enterococcus faecium*	4	<=0.03	<=0.5	2	8	1	<=1	<=8	2	<=0.5	<=1	<=1
EURL ENT 11.5	*Enterococcus faecium*	4	0.12	<=0.5	8	8	0.5	>128	<=8	2	8	64	<=1
EURL ENT 11.6	*Enterococcus faecium*	4	0.25	1	>64	8	>16	>128	>1024	2	2	128	32
EURL ENT 11.7	*Enterococcus faecium*	1	0.25	64	4	8	1	2	<=8	4	4	64	>128
EURL ENT 11.8	*Enterococcus faecalis*	4	0.25	<=0.5	2	64	1	>128	<=8	16	16	128	2

Expected interpretation

Strain ID	Species	Antimicrobial											
		DAP	TIG	TEI	AMP	CHL	CIP	ERY	GEN	LZD	Q-D	TET	VAN
EURL ENT 11.1	*Enterococcus faecium*	S	S	R	S	S	S	S	S	S	S	R	R
EURL ENT 11.2	*Enterococcus faecalis*	S	S	S	S	R	S	R	R	S	NA	R	S
EURL ENT 11.3	*Enterococcus faecalis*	S	S	R	S	R	R	R	R	S	NA	R	R
EURL ENT 11.4	*Enterococcus faecium*	S	S	S	S	S	S	S	S	S	S	S	S
EURL ENT 11.5	*Enterococcus faecium*	S	S	S	R	S	S	R	S	S	R	R	S
EURL ENT 11.6	*Enterococcus faecium*	S	S	S	R	S	R	R	R	S	S	R	R
EURL ENT 11.7	*Enterococcus faecium*	S	S	R	S	S	S	S	S	S	S	R	R
EURL ENT 11.8	*Enterococcus faecalis*	S	S	S	S	R	S	R	S	R	NA	R	S

Abbreviations

DAP, daptomycin
TIG, tigecycline
TEI, teicoplanin
AMP, ampicillin
CHL, chloramphenicol
CIP, ciprofloxacin
ERY, erythromycin
GEN, gentamicin
LZD, linezolid
Q-D, quinupristin-dalfopristin (synercid)
TET, tetracycline
VAN, vancomycin
R, resistant
S, susceptible
NA, not applicable

Color legend	
	resistant
	susceptible

Appendix 3b

Expected MIC values

Strain ID	Species	Antimicrobial														
		VAN	Q-D	LZD	MUP	CLN	CHL	CIP	ERY	FOX	GEN	SMX	TET	TIA	TMP	SXT
EURL ST 11.1	*Staphylococcus aureus*	<=1	<=0.5	2	<=0.5	<=0.12	8	<=0.25	0.5	4	<=1	<=64	<=0.5	1	<=2	<=0.25
EURL ST 11.2	*Staphylococcus aureus*	<=1	4	8	<=0.5	>4	>64	<=0.25	0.5	8	<=1	<=64	>16	>4	>32	0.5
EURL ST 11.3	*Staphylococcus aureus*	<=1	2	2	<=0.5	>4	8	<=0.25	0.5	8	<=1	<=64	>16	>4	>32	0.5
EURL ST 11.4	*Staphylococcus aureus*	<=1	<=0.5	2	<=0.5	0.25	8	0.5	0.5	8	<=1	<=64	<=0.5	1	<=2	<=0.25
EURL ST 11.5	*Staphylococcus aureus*	<=1	1	2	256	>4	8	>8	>8	>16	>16	<=64	<=0.5	<=0.5	<=2	<=0.25
EURL ST 11.6	*Staphylococcus aureus*	<=1	<=0.5	2	<=0.5	<=0.12	8	2	<=0.25	16	>16	256	>16	1	<=2	<=0.25
EURL ST 11.7	*Staphylococcus aureus*	<=1	>4	2	<=0.5	>4	16	8	>8	8	<=1	<=64	>16	>4	>32	0.5
EURL ST 11.8	*Staphylococcus aureus*	<=1	<=0.5	2	<=0.5	<=0.12	8	0.5	>8	4	<=1	>512	>16	1	<=2	<=0.25

Expected interpretation

Strain ID	Species	Antimicrobial															MRSA*
		VAN	Q-D	LZD	MUP	CLN	CHL	CIP	ERY	FOX	GEN	SMX	TET	TIA	TMP	SXT	
EURL ST 11.1	*Staphylococcus aureus*		S	S	S	S	S	S	S	S	S	S	S	S	S	S	negative
EURL ST 11.2	*Staphylococcus aureus*	S	R	R	S	R	R	S	S	R	S	S	R	R	R	S	positive
EURL ST 11.3	*Staphylococcus aureus*	S	R	S	S	R	S	S	S	R	S	S	R	R	R	S	positive
EURL ST 11.4	*Staphylococcus aureus*	S	S	S	S	S	S	S	S	R	S	S	S	S	S	S	positive
EURL ST 11.5	*Staphylococcus aureus*	S	S	S	R	R	S	R	R	R	R	S	S	S	S	S	positive
EURL ST 11.6	*Staphylococcus aureus*	S	S	S	S	S	S	R	S	R	R	R	R	S	S	S	positive
EURL ST 11.7	*Staphylococcus aureus*	S	R	S	S	R	S	R	R	R	S	S	R	R	R	S	positive
EURL ST 11.8	*Staphylococcus aureus*	S	S	S	S	S	S	S	R	S	S	R	R	S	S	S	negative

Abbreviations

VAN, vancomycin
Q-D, quinupristin-dalfopristin (synercid)
LZD, linezolid
MUP, muprocin
CLN, clindamycin
CHL, chloramphenicol
CIP, ciprofloxacin
ERY, erythromycin
FOX, cefoxitin
GEN, gentamicin
SMX, sulphamethoxazole
TET, tetracycline
TIA, tiamulin
TMP, trimethoprim
SXT, sulphamethoxazole+trimethoprim
R, resistant
S, susceptible
NA, not applicable

Color legend	
	resistant
	susceptible

*the interpretation for MRSA is "positive" or "negative"

Appendix 3c_1

Expected MIC values

Strain ID	Species	Antimicrobial													
		AMP	MER	COL	CHL	CIP	TAZ	FOT	GEN	NAL	SMX	TET	TMP	AZI	TIG
EURL EC 11.1	*Escherichia coli*	>64	<=0.03	<=1	<=8	<=0.015	4	>4	1	<=4	<=8	<=2	<=0.25	16	<=0.25
EURL EC 11.2	*Escherichia coli*	4	<=0.03	<=1	<=8	<=0.015	<=0.5	<=0.25	1	<=4	<=8	<=2	<=0.25	8	<=0.25
EURL EC 11.3	*Escherichia coli*	>64	<=0.03	4	64	>8	8	>4	32	>128	>1024	>64	>32	8	<=0.25
EURL EC 11.4	*Escherichia coli*	>64	<=0.03	<=1	<=8	<=0.015	<=0.5	<=0.25	1	<=4	>1024	>64	>32	64	<=0.25
EURL EC 11.5	*Escherichia coli*	>64	8	<=1	<=8	0.06	>8	>4	>32	<=4	>1024	<=2	<=0.25	8	<=0.25
EURL EC 11.6	*Escherichia coli*	>64	<=0.03	4	>128	0.5	<=0.5	<=0.25	<=0.5	16	>1024	>64	>32	4	<=0.25
EURL EC 11.7	*Escherichia coli*	>64	<=0.03	<=1	16	0.03	8	4	<=0.5	<=4	>1024	4	>32	>64	<=0.25
EURL EC 11.8	*Escherichia coli*	>64	1	<=1	16	1	4	>4	<=0.5	32	>1024	>64	>32	8	<=0.25

Expected interpretation

Strain ID	Species	Antimicrobial													
		AMP	MER	COL	CHL	CIP	TAZ	FOT	GEN	NAL	SMX	TET	TMP	AZI	TIG
EURL EC 11.1	*Escherichia coli*	R	S	S	S	S	R	R	S	S	S	S	S	S	S
EURL EC 11.2	*Escherichia coli*	S	S	S	S	S	S	S	S	S	S	S	S	S	S
EURL EC 11.3	*Escherichia coli*	R	S	R	R	R	R	R	R	R	R	R	R	S	S
EURL EC 11.4	*Escherichia coli*	R	S	S	S	S	S	S	S	S	R	R	R	R	S
EURL EC 11.5	*Escherichia coli*	R	R	S	S	S	R	R	R	S	R	S	S	S	S
EURL EC 11.6	*Escherichia coli*	R	S	R	R	R	S	S	S	S	R	R	R	S	S
EURL EC 11.7	*Escherichia coli*	R	S	S	S	S	R	R	S	S	R	S	R	R	S
EURL EC 11.8	*Escherichia coli*	R	R	S	S	R	R	R	S	R	R	R	R	S	S

Abbreviations

AMP, ampicillin
MER, meropenem
COL, colistin
CHL, chloramphenicol
CIP, ciprofloxacin
TAZ, ceftazidime
FOT, cefotaxime
GEN, gentamicin
NAL, nalidixic acid
SMX, sulphamethoxazole
TET, tetracycline
TMP, trimethoprim
AZT, azithromycin
TIG, tigecycline
R, resistant
S, susceptible

Color legend	
	resistant
	susceptible

Appendix 3c_2

Expected MIC values

Strain ID	Species	Antimicrobial									
		FOX	TAZ	TAZ+CL	FOT	FOT+CL	FEP	MER	IMI	ETP	TRM
EURL EC 11.1	*Escherichia coli*	4	2	<=0.12	>64	<=0.06	16	<=0.03	<=0.12	<=0.015	<=4
EURL EC 11.2	*Escherichia coli*	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
EURL EC 11.3	*Escherichia coli*	4	8	0.25	8	<=0.06	2	<=0.03	0.25	0.03	8
EURL EC 11.4	*Escherichia coli*	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
EURL EC 11.5	*Escherichia coli*	>64	>128	>128	>64	>64	32	8	4	>2	32
EURL EC 11.6	*Escherichia coli*	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
EURL EC 11.7	*Escherichia coli*	64	8	8	4	1	0.12	<=0.03	<=0.12	0.03	8
EURL EC 11.8	*Escherichia coli*	16	8	2	4	1	4	2	2	2	16

Expected interpretation

Strain ID	Species	Antimicrobial										Presumptive mechanism mediating cephalosporin and/or carbapapenem resistance					
		FOX	TAZ	TAZ+CL*	FOT	FOT+CL*	FEP	MER	IMI	ETP	TRM**	ESBL	AmpC	ESBL+AmpC	Carbapenemase	Other	None
EURL EC 11.1	*Escherichia coli*	S	R	SYNERGY	R	SYNERGY	R	S	S	S	NA	YES	NO	NO	NO	NO	NO
EURL EC 11.2	*Escherichia coli*	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NO	NO	NO	NO	NO	YES
EURL EC 11.3	*Escherichia coli*	S	R	SYNERGY	R	SYNERGY	R	S	S	S	NA	YES	NO	NO	NO	NO	NO
EURL EC 11.4	*Escherichia coli*	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NO	NO	NO	NO	NO	YES
EURL EC 11.5	*Escherichia coli*	R	R	NO SYNERGY	R	NO SYNERGY	R	R	R	R	NA	NO	NO	NO	YES	NO	NO
EURL EC 11.6	*Escherichia coli*	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NO	NO	NO	NO	NO	YES
EURL EC 11.7	*Escherichia coli*	R	R	NO SYNERGY	R	NO SYNERGY	S	S	S	S	NA	NO	YES	NO	NO	NO	NO
EURL EC 11.8	*Escherichia coli*	R	R	NO SYNERGY	R	NO SYNERGY	R	R	R	R	NA	NO	NO	NO	YES	NO	NO

Abbreviations

FOX, cefoxitin
TAZ, ceftazidime
TAZ+CL, ceftazidime+clavulanic acid
FOT, cefotaxime
FOT+CL, cefotaxime+clavulanic acid
FEP, cefepime
MER, meropenem
IMI, imipenem
ETP, ertapenem
TRM, temocillin
R, resistant
S, susceptible
NA, not applicable
NR, not relevant

*interpretation of TAZ+CL and FOT+CL is SYNERGY or NO SYNERGY
**interpretation for temocillin is not available, so participants should be requested to upload only the MIC value

Color legend	
	resistant
	susceptible

Appendix 4a

National Food Institute

G00-06-001/01.12.2014

EURL-AR External Quality Assurance System (EQAS) 2017:

-*Escherichia coli*, staphylococci and enterococci

Id: XXXX

Lyngby, 20th June 2017

Dear XXX

Please find enclosed the bacterial strains for the EURL-AR EQAS 2017: eight *E. coli*, eight *S. aureus* and eight *Enterococcus* spp. Upon arrival to your laboratory, the strains should be stored in a dark place at 4°C for stabs, and in a dark and cool place for freeze-dried strains.

On the EURL-AR-website (www.eurl-ar.eu) the following documents relevant for this EURL-AR EQAS are available:

- Protocol for antimicrobial susceptibility testing of *E. coli*, staphylococci and enterococci and test forms for reporting results
- Instructions for Opening and Reviving Lyophilised Cultures
- Subculture and Maintenance of Quality Control Strains

We ask you to test these *E. coli*, enterococci and *S. aureus* strains for antimicrobial susceptibility. Detailed description of the procedures to follow for antimicrobial susceptibility testing and for entering your results into the interactive web database can be found in the protocol. For accessing the database, you need this username and password:

Your username: xxx

Your password: xxx

Please keep this document
Your username and password will not appear in other documents

Results should be entered in the database no later than **8th September 2017.** Please acknowledge receipt of this parcel immediately upon arrival to vabo@food.dtu.dk and do not hesitate to contact me for further information.

Yours sincerely,

Valeria Bortolaia

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www.food.dtu.dk

EU Reference Laboratory for Antimicrobial Resistance
External Quality Assurance System (EQAS) 2017

DTU Food
National Food Institute

PROTOCOL

For antimicrobial susceptibility testing of *Escherichia coli*, enterococci and staphylococci

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1 INTRODUCTION

The organisation and implementation of an External Quality Assurance System (EQAS) on antimicrobial susceptibility testing (AST) of *E. coli*, enterococci and staphylococci is among the tasks of the EU Reference Laboratory for Antimicrobial Resistance (EURL-AR). The EC/Ent/Staph EQAS 2017 will include AST of eight *Escherichia coli*, eight enterococci and eight staphylococci strains and AST of reference strains *E. coli* ATCC 25922 (CCM 3954), *E. faecalis* ATCC 29212 (CCM 4224), and *S. aureus* ATCC 29213 (CCM 4223).

The reference strains are included in the parcel only for new participants of the EQAS who did not receive them previously. The reference strains are original CERTIFIED cultures provided free of charge, and should be used for future internal quality control for antimicrobial susceptibility testing in your laboratory. The reference strains will not be included in the years to come. Therefore, please take proper care of these strains. Handle and maintain them as suggested in the manual 'Subculture and Maintenance of QC Strains' available on the EURL-AR website (see www.eurl-ar.eu).

Various aspects of the proficiency test scheme may from time to time be subcontracted. When subcontracting occurs it is placed with a competent subcontractor and the National Food Institute is responsible to the scheme participants for the subcontractor's work.

2 OBJECTIVES

This EQAS aims to support laboratories to assess and, if necessary, to improve the quality of results obtained by AST of pathogens of food- and animal-origin, with special regard to *E. coli*, enterococci and staphylococci. Further objectives are to evaluate and improve the comparability of surveillance data on antimicrobial susceptibility of *E. coli*, enterococci and staphylococci reported to EFSA by different laboratories.

3 OUTLINE OF THE EC/ENT/STAPH EQAS 2017

Shipping, receipt and storage of strains

In June 2017, the National Reference Laboratories for Antimicrobial Resistance (NRL-AR) will receive a parcel containing eight *E. coli*, eight enterococci and eight staphylococci strains from the DTU National Food Institute. This parcel will also contain reference strains, but only for participants who did not receive them previously.

All strains belong to UN3373, Biological substance, category B. Extended-spectrum beta-lactamase (ESBL)-producing strains as well as carbapenemase-producing strains and methicillin-resistant *Staphylococcus aureus* (MRSA) will be included in the selected material.

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It is the recipients' responsibility to comply with national legislation, rules and regulation regarding the correct use and handling of the provided strains and to possess the proper equipment and protocols to handle these strains.

The reference strains are shipped lyophilised, while the test strains are stab cultures. On arrival, the stab cultures must be subcultured, and all cultures should be adequately stored until testing. A suggested procedure for reconstitution of the lyophilised reference strains is presented below.

Suggested procedure for reconstitution of the lyophilised reference strains

Please refer to the document 'Instructions for opening and reviving lyophilised cultures' reported on the EURL-AR-website (see www.eurl-ar.eu).

Antimicrobial susceptibility testing

The strains should be tested for susceptibility to the antimicrobials listed in Tables 1, 2 and 3, using the method implemented in your laboratory for performing monitoring for EFSA and applying the interpretative criteria listed below.

Participants should perform minimum inhibitory concentration (MIC) determination using the methods stated in the Commission Implementing Decision 2013/652/EU. For staphylococci, MIC methods should be used as well, according to the EFSA recommendations and the antimicrobials to test are those stated under the EFSA technical specifications (see Table 3). For interpretation of the results, use the cut-off values listed in Tables 1, 2, 3 and 4 in this document. These values (except where indicated) represent the current epidemiological cut-off values developed by EUCAST (www.eucast.org), and allow categorisation of bacterial isolates into two categories: resistant or susceptible. A categorisation as intermediate is not accepted**.**

Participants will not be allowed to use disk diffusion as the current regulation and recommendations only focus on MIC testing.

3.1.1 *E. coli*

Table 1. Antimicrobials recommended for AST of *Escherichia coli* and interpretative criteria according to table 1 in Commission Implementing Decision 2013/652/EU

Antimicrobials for *E. coli*	MIC (µg/mL) **R is >**
Ampicillin, AMP	8
Azithromycin, AZI	16*
Cefotaxime, FOT	0.25
Ceftazidime, TAZ	0.5
Chloramphenicol, CHL	16
Ciprofloxacin, CIP	0.064
Colistin, COL	2
Gentamicin, GEN	2
Meropenem, MERO	0.125
Nalidixic acid, NAL	16
Sulfamethoxazole, SMX	64
Tetracycline, TET	8
Tigecycline, TGC	0.5
Trimethoprim, TMP	2

* Tentative ECOFF

Plasmid-mediated quinolone resistance

When performing antimicrobial susceptibility testing of *E. coli*, the interpretative criteria listed in Table 1 for results obtained by MIC-determination should allow detection of plasmid-mediated quinolone-resistant test strains.

Beta-lactam resistance

Confirmatory tests for ESBL production are mandatory on all strains resistant to cefotaxime (FOT), ceftazidime (TAZ) and/or meropenem and should be performed by testing the second panel of antimicrobials (Table 2 in this document corresponding to Table 4 in Commission Implementing Decision 2013/652/EU).

Table 2. Antimicrobials recommended for additional AST of *Escherichia coli* resistant to cefotaxime, ceftazidime or meropenem and interpretative criteria according to table 4 in Commission Implementing Decision 2013/652/EU

Antimicrobials for *E. coli*	MIC (µg/mL) **R is >**
Cefepime, FEP	0.125
Cefotaxime, FOT	0.25
Cefotaxime + clavulanic acid (F/C)	Not applicable
Cefoxitin, FOX	8
Ceftazidime, TAZ	0.5
Ceftazidime+ clavulanic acid (T/C)	Not applicable
Ertapenem, ETP	0.064
Imipenem, IMI	0.5
Meropenem, MERO	0.125
Temocillin, TRM	>32*

*Tentative ECOFF

Confirmatory test for ESBL production requires use of both cefotaxime (FOT) and ceftazidime (TAZ) alone and in combination with a β-lactamase inhibitor (clavulanic acid). Synergy is defined either as i) a ≥ 3 twofold concentration decrease in an MIC for either antimicrobial agent tested in combination with clavulanic acid vs. the MIC of the agent when tested alone (MIC FOT : FOT/CL or TAZ : TAZ/CL ratio ≥ 8) (CLSI M100 Table 3A, Tests for ESBLs). The presence of synergy indicates ESBL production.

Confirmatory test for carbapenemase production requires the testing of meropenem (MERO).

Detection of AmpC-type beta-lactamases can be performed by testing the bacterium for susceptibility to cefoxitin (FOX). Resistance to FOX could indicate the presence of an AmpC-type beta-lactamase.

The classification of the phenotypic results should be based on the most recent EFSA recommendations (available in The European Union summary report on antimicrobial resistance in zoonotic and indicator bacteria from humans, animals and food in 2015, EFSA Journal 2017;15(2):4694,212 pp. (page 43), and in the appendix to this protocol). It is important to notice that two cut-off values apply for cefotaxime and ceftazidime: the EUCAST cut-off values (ECOFFs: FOT>0.25 and TAZ>0.5), which are those used to define R/S, and the screening cut-off values (FOT>1 and TAZ>1), which are those applied to categorise bacterial phenotypes as ESBL, AmpC, carbapenemase, etc. based on panel 2 results (see Appendix). The screening cut-off values are higher than the ECOFF values to increase sensitivity and specificity.

3.1.2 Enterococci

Table 3. Antimicrobials recommended for AST of *Enterococcus* spp. and interpretative criteria according to table 3 in Commission Implementing Decision 2013/652/EU

Antimicrobials for enterococci	MIC (µg/mL) **R is >** *E. faecium*	MIC (µg/mL) **R is >** *E. faecalis*
Ampicillin, AMP	4	4
Chloramphenicol, CHL	32	32
Ciprofloxacin, CIP	4	4
Daptomycin, DAP	4	4
Erythromycin, ERY	4	4
Gentamicin, GEN	32	32
Linezolid, LZD	4	4
Quinupristin-dalfopristin (Synercid), SYN	4*	Intrinsically resistant
Teicoplanin, TEI	2	2
Tetracycline, TET	4	4
Tigecycline, TGC	0.25	0.25
Vancomycin, VAN	4	4

*DANMAP 2009 (www.danmap.org)

Identification of *Enterococcus* spp.

Species identification of enterococci must be performed by the NRLs using in-house methods or adopting the protocol available on the EURL-AR website under: www.eurl-ar.eu/233-protocols.htm.

3.1.3 Staphylococci

Table 4. Antimicrobials recommended for AST of *Staphylococcus aureus* and interpretative criteria according to EFSA technical specifications (EFSA Journal 2012;10(10):2897)

Antimicrobials for *S. aureus*	MIC (µg/mL) **R is >**
Cefoxitin, FOX	4
Chloramphenicol, CHL	16
Ciprofloxacin, CIP	1
Clindamycin, CLN	0.25
Erythromycin, ERY	1
Gentamicin, GEN	2
Linezolid, LZD	4
Mupirocin, MUP	1
Quinupristin-dalfopristin (Synercid), SYN	1
Sulfamethoxazole, SMX	128
Sulfamethoxazole+Trimethoprim, SXT	0.5
Tetracycline, TET	1
Tiamulin, TIA	2
Trimethoprim, TMP	2
Vancomycin, VAN	2

Identification of MRSA

Confirmation of *mec*A and/or *mecC* presence is mandatory in this EQAS. For this purpose, you are recommended to use the PCR method protocol recommended by the EURL-AR (www.eurl-ar.eu/233-protocols.htm) and upload the result as 'positive' or 'negative'.

4 REPORTING OF RESULTS AND EVALUATION

Please write your results in the test forms, and enter your results into the interactive web database. In addition, we kindly ask you to report in the database the tested MIC range for the staphylococci tests (for this organism only, as it is not included the Commission Implementing Decision 2013/652/EU). Finally, if **you did not use the cut-off values recommended in the protocol for interpretation of *Staphylococcus* AST results**, please report the breakpoints used in the database.

4.1 General recommendations for data upload

We recommend reading carefully the description reported in paragraph 5 before entering your results in the web database. **Results must be submitted no later than September 8th, 2017.** After the deadline when all participants have uploaded results, you will be able to login to the database once again, and to view and print an automatically generated report evaluating your results. Results in agreement with the expected interpretation are categorised as 'correct', while results deviating from the expected interpretation are categorised as 'incorrect'.

If you experience difficulties in entering your results, please contact us directly.

All results will be summarised in a report which will be publicly available. The data in the report will be presented with laboratory codes. A laboratory code is known to the individual laboratory, whereas the complete list of laboratories and their codes is confidential and known only to the EURL-AR and the EU Commission. All conclusions will be public.

If you have questions, please do not hesitate to contact the EQAS Coordinator:

Susanne Karlsmose Pedersen
National Food Institute
Technical University of Denmark
Kemitorvet, Building 204, DK-2800 Lyngby

Denmark

Tel: +45 3588 6601
E-mail: suska@food.dtu.dk

5 HOW TO ENTER RESULTS IN THE INTERACTIVE DATABASE

Please read carefully this paragraph before entering the web page.
Remember that you need by your side the completed test forms and the breakpoint values you used.

Enter the EURL-AR EQAS 2017 start web page (http://eurl-ar.food.dtu.dk/01), write your username and password in lower-cases and press enter. Your username and password are indicated in the letter accompanying your strains. Do not hesitate to contact us if you experience problems with the login.

You can browse back and forth by using the Home or back keys, but please remember to save your inputs before.

5.1 AST of *E. coli*, enterococci and staphylococci

Click on either "*E. coli*", "enterococci" or "staphylococci" for input of test results based on the results you are going to upload.

Click on "Start of Data Entry - Methods and Breakpoints".

In the next page, you can navigate among fields with the Tab-key and the mouse.

Complete the fields related to the method used for antimicrobial susceptibility testing and the brand of MIC trays, etc.

Click on "save" and then go back using the tab "home" and enter another test page to upload results.

In the data entry pages, enter the obtained values and the interpretation (R, resistant or S, susceptible) for each *E. coli*, enterococcus and staphylococcus strain.

For *E. coli* strains, remember to report also the results for the ESBL detection tests.
For *S. aureus* strains, remember to report also the results for presence/absence of methicillin resistance.

If you did not test for susceptibility to a given antimicrobial, please leave the field empty.

Click on "save" and then go back using the tab "home" and enter another test page to upload results.

When uploading data on the reference strains, please enter MIC values in µg/ml. Remember to use the operator keys to show symbols like "equal to", etc.

Click on "save".

Review the input pages by browsing through the pages and make corrections if necessary. Remember to save a page if you make corrections. If you press home to leave a page without saving changes, you will see an error screen. In this case, click on "save" to save your results, browse back to the page and then continue.

Please complete the evaluation form.

Before approving your input, please be sure that you have filled in all the relevant fields because YOU CAN ONLY APPROVE ONCE! The approval blocks your data entry in the interactive database.

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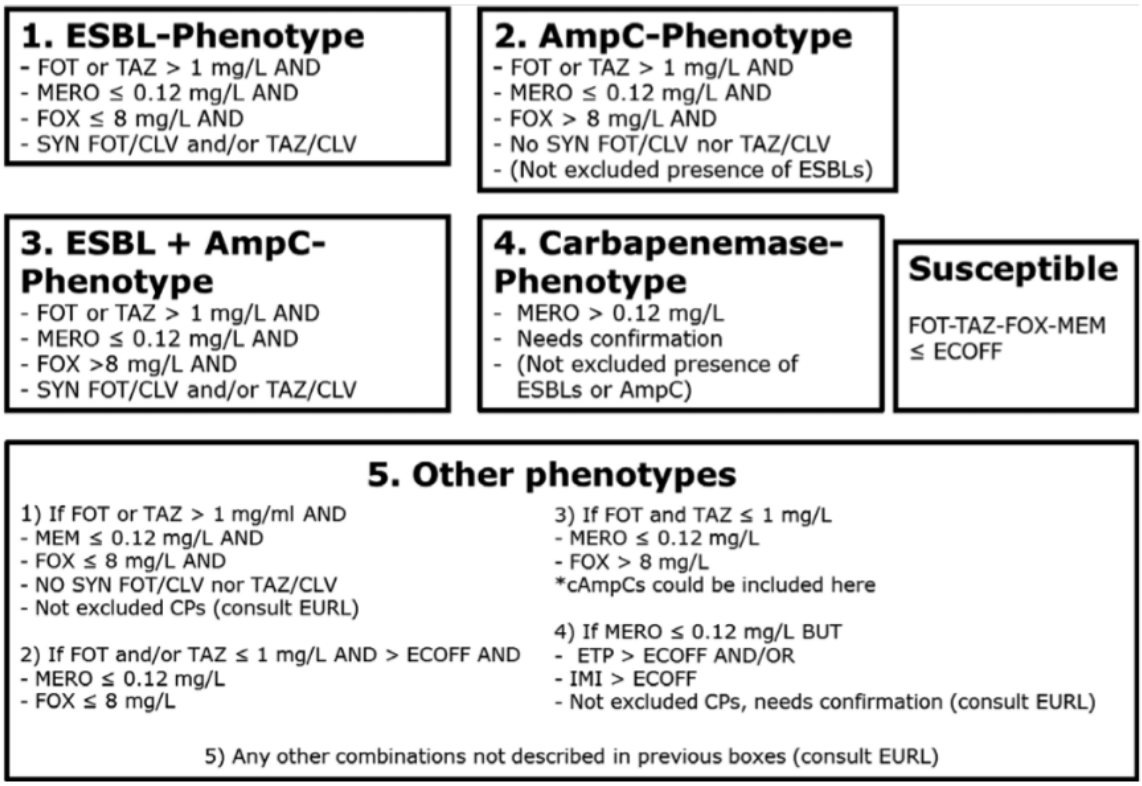
APPENDIX

Criteria for interpretation of *Escherichia coli*, panel 2 results



Please refer to: EFSA (European Food Safety Authority) and ECDC (European Centre for Disease Prevention and Control), 2017. The European Union summary report on antimicrobial resistance in zoonotic and indicator bacteria from humans, animals and food in 2015. EFSA Journal 2017;15(2):4694, 212 pp. doi:10.2903/j.efsa.2017.4694 (page 43).

EU Reference Laboratory for Antimicrobial Resistance
External Quality Assurance System (EQAS) 2017

DTU Food
National Food Institute

Antimicrobial susceptibility testing of *Escherichia coli*, enterococci and staphylococci

TEST FORMS

Name:
Name of laboratory:
Name of institute:
City:
Country:
E-mail:
Fax:

Comments:

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TEST FORMS METHODS - Enterococci

Which method did you use for antimicrobial susceptibility testing of enterococci in this EQAS:

☐ MIC – Microtitre
☐ MIC – Agar dilution
Brand**:**

How many *Enterococcus* spp. isolates does your laboratory annually isolate:

How many *Enterococcus* spp. isolates does your laboratory annually test for antimicrobial susceptibility by a MIC method:

Which method was followed for the preparation of the inoculum? Please describe:

- Which standard was followed (TREK, CLSI…)
- Which solvent was used for the preparation of the 0.5 McFarland solution (water, saline)
- Please describe in detail how you prepared the dilution of the inoculum (including the volume in final MH-dilution and intended dilution level; e.g. diluted 1:1000 by adding 10µl of 0.5 McFarland solution in 10 ml MH broth, for an expected inoculum of $1*10^5$ CFU/ml)

Comments or additional information:

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TEST FORMS METHODS - Staphylococci

Which method did you use for antimicrobial susceptibility testing of staphylococci in this EQAS:

☐ MIC – Microtitre
☐ MIC – Agar dilution
Brand**:**

How many *Staphylococcus* spp. isolates does your laboratory annually isolate:
How many *Staphylococcus* spp. isolates does your laboratory annually test for antimicrobial susceptibility by a MIC method:
Which method was followed for the preparation of the inoculum? Please describe:

- Which standard was followed (TREK, CLSI…)
- Which solvent was used for the preparation of the 0.5 McFarland solution (water, saline)
- Please describe in detail how you prepared the dilution of the inoculum (including the volume in final MH-dilution and intended dilution level; e.g. diluted 1:1000 by adding 10µl of 0.5 McFarland solution in 10 ml MH broth, for an expected inoculum of $1*10^5$ CFU/ml)

Comments or additional information:

Antimicrobial	General information The relevant information in the four columns below should be reported			
	Test-range for MIC (µg/ml)	Resistant (µg/ml)	Intermediate (µg/ml)	Susceptible (µg/ml)
Cefoxitin, FOX		≤		≥
Chloramphenicol, CHL		≤		≥
Ciprofloxacin, CIP		≤		≥
Clindamycin, CLN		≤		≥
Erythromycin, ERY		≤		≥
Gentamicin, GEN		≤		≥
Linezolid, LZD		≤		≥
Mupirocin, MUP		≤		≥
Quin.-Dalf. (Synercid), SYN		≤		≥
Sulfamethoxazole, SMX		≤		≥
Sulfamethoxazole + trimethoprim, SXT		≤		≥
Tetracycline, TET		≤		≥
Tiamulin (TIA)		≤		≥
Trimethoprim, TMP		≤		≥
Vancomycin, VAN		≤		≥

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TEST FORMS METHODS – *Escherichia coli*

Which method did you use for antimicrobial susceptibility testing of *E. coli* in this EQAS:

☐ MIC – Microtitre
☐ MIC – Agar dilution

Brand**:**

Incubation conditions: °C/ h

How many *E. coli* isolates does your laboratory annually isolate:

How many *E. coli* isolates does your laboratory annually test for antimicrobial susceptibility by a MIC method:

Which method was followed for the preparation of the inoculum? Please describe:

- Which standard was followed (TREK, CLSI…)
- Which solvent was used for the preparation of the 0.5 McFarland solution (water, saline)
- Please describe in detail how you prepared the dilution of the inoculum (including the volume in final MH-dilution and intended dilution level; e.g. diluted 1:1000 by adding 10µl of 0.5 McFarland solution in 10 ml MH broth, for an expected inoculum of $1*10^5$ CFU/ml)

Comments or additional information:

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TEST FORM - Enterococci

Strain	Antimicrobial	Results and interpretation		
		≤ >	MIC-value (µg/ml)	S / R
Enterococci EURL ENT. 11.X ☐ *E. faecium* ☐ *E. faecalis*	Ampicillin AMP			
	Chloramphenicol, CHL			
	Ciprofloxacin, CIP			
	Daptomycin, DAP			
	Erythromycin, ERY			
	Gentamicin, GEN			
	Linezolid, LZD			
	Quin.-Dalf. (Synercid), SYN			
	Teicoplanin, TEI			
	Tetracycline, TET			
	Tigecycline, TGC			
	Vancomycin, VAN			

Strain	Antimicrobial	Results and interpretation		
		≤ >	MIC-value (µg/ml)	S / R
Enterococci EURL ENT. 11.X ☐ *E. faecium* ☐ *E. faecalis*	Ampicillin AMP			
	Chloramphenicol, CHL			
	Ciprofloxacin, CIP			
	Daptomycin, DAP			
	Erythromycin, ERY			
	Gentamicin, GEN			
	Linezolid, LZD			
	Quin.-Dalf. (Synercid), SYN			
	Teicoplanin, TEI			
	Tetracycline, TET			
	Tigecycline, TGC			
	Vancomycin, VAN			

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TEST FORM - Enterococci

Antimicrobial susceptibility testing of reference strain *Enterococcus faecalis* ATCC 29212

Antimicrobial	MIC-value (µg/ml)
Ampicillin, AMP	
Chloramphenicol, CHL	
Ciprofloxacin, CIP	
Daptomycin, DAP	
Erythromycin, ERY	
Gentamicin, GEN	
Linezolid, LZD	
Quinupristin-Dalfopristin (Synercid), SYN	
Teicoplanin, TEI	
Tetracycline, TET	
Tigecycline, TIG	
Vancomycin, VAN	

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TEST FORMS - Staphylococci

Strain	Antimicrobial	Results and interpretation		
		≤ >	MIC-value (µg/ml)	S / R
S. aureus EURL ST 11.X	Cefoxitin, FOX			
	Chloramphenicol, CHL			
	Ciprofloxacin, CIP			
	Clindamycin, CLN			
	Erythromycin, ERY			
	Gentamicin, GEN			
	Linezolid, LZD			
	Mupirocin, MUP			
	Quinu-dalfopristin (Synercid), SYN			
	Sulfamethoxazole, SMX			
	Sulfamethoxazole+Trimethoprim, SXT			
	Tetracycline, TET			
	Tiamulin, TIA			
	Trimethoprim, TMP			
	Vancomycin, VAN			

Methicillin resistance (MRSA)	☐ Positive ☐ Negative

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TEST FORM - Staphylococci

Antimicrobial susceptibility testing of reference strain *S. aureus* ATCC 29213 (MIC)

Antimicrobial	MIC-value (µg/ml)
Cefoxitin, FOX	
Chloramphenicol, CHL	
Ciprofloxacin, CIP	
Clindamycin, CLN	
Erythromycin, ERY	
Gentamicin, GEN	
Linezolid, LZD	
Mupirocin, MUP	
Quinupristin-dalfopristin (Synercid), SYN	
Sulfamethoxazole, SMX	
Sulfamethoxazole + trimethoprim, SXT	
Tetracycline, TET	
Tiamulin, TIA	
Trimethoprim, TMP	
Vancomycin, VAN	

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TEST FORM – *E. coli*

Strain	Antimicrobial	Results and interpretation		
		≤ >	MIC-value (µg/ml)	S / R
E. coli EURL EC 11.X	Ampicillin, AMP			
	Azithromycin, AZT			
	Cefotaxime, FOT			
	Ceftazidime, TAZ			
	Chloramphenicol, CHL			
	Ciprofloxacin CIP			
	Colistin, COL			
	Gentamicin, GEN			
	Meropenem, MERO			
	Nalidixic acid, NAL			
	Sulfamethoxazole, SMX			
	Tetracycline, TET			
	Tigecycline, TGC			
	Trimethoprim, TMP			

All strains resistant to cefotaxime (FOT), ceftazidime (TAZ) or meropenem (MERO) should be included for testing in the second panel confirmatory tests for ESBL or carbapenemase production. See further description of confirmatory tests in the protocol section '*3.1.1 E. coli*'.

Strain	Antimicrobial	Results and interpretation		
		≤ >	MIC-value (µg/ml)	S / R
E. coli EURL EC 11.X	Cefepime, FEP			
	Cefotaxime, FOT			
	Cefotaxime + clavulanic acid (F/C)			
	Cefoxitin, FOX			
	Ceftazidime, TAZ			
	Ceftazidime+ clavulanic acid (T/C)			
	Ertapenem, ETP			
	Imipenem, IMI			
	Meropenem, MERO			
	Temocillin, TRM			

Interpretation of PANEL 2 results:

☐ Presumptive ESBL	☐ Presumptive AmpC	☐ Other phenotype
☐ Presumptive ESBL+ AmpC	☐ Presumptive carbapenemase	☐ Susceptible

Comments (include optional genotype or other results):

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TEST FORM – *E. coli*

Antimicrobial susceptibility testing of reference strain *E. coli* ATCC 25922

	Antimicrobial	MIC-value (µg/ml)
1st panel	Ampicillin, AMP	
	Azithromycin, AZT	
	Cefotaxime, FOT	
	Ceftazidime, TAZ	
	Chloramphenicol, CHL	
	Ciprofloxacin, CIP	
	Colistin, COL	
	Gentamicin, GEN	
	Meropenem, MERO	
	Nalidixic acid, NAL	
	Sulfamethoxazole, SMX	
	Tetracycline, TET	
	Tigecycline, TGC	
	Trimethoprim, TMP	
2nd panel	Cefepime, FEP	
	Cefotaxime, FOT	
	Cefotaxime + clavulanic acid (F/C)	
	Cefoxitin, FOX	
	Ceftazidime, TAZ	
	Ceftazidime+ clavulanic acid (T/C)	
	Ertapenem, ETP	
	Imipenem, IMI	
	Meropenem, MERO	
	Temocillin, TRM	

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INSTRUCTIONS FOR OPENING AND REVIVING LYOPHILISED CULTURES

Instructions adjusted from Czech Collection of Microorganisms (CCM) document 'Instructions for Opening and Reviving of Freeze-Dried Bacteria and Fungi' available on http://www.sci.muni.cz.

Lyophilised cultures are supplied in vacuum-sealed ampoules. Care should be taken in opening the ampoule. All instructions given below should be followed closely to ensure the safety of the person who opens the ampoule and to prevent contamination of the culture.

a. Check the number of the culture on the label inside the ampoule
b. Make a file cut on the ampoule near the middle of the plug (see Figure 1)
c. Disinfect the ampoule with alcohol-dampened gauze or alcohol-dampened cotton wool from just below the plug to the pointed end
d. Apply a red-hot glass rod to the file cut to crack the glass and allow air to enter slowly into the ampoule
e. Remove the pointed end of the ampoule into disinfectant
f. Add about 0.3 ml appropriate broth to the dried suspension using a sterile Pasteur pipette and mix carefully to avoid creating aerosols. Transfer the contents to one or more suitable solid and /or liquid media
g. Incubate the inoculated medium at appropriate conditions for several days
h. Autoclave or disinfect effectively the used Pasteur pipette, the plug and all the remains of the original ampoule before discarding

Notes:

- Cultures should be grown on media and under conditions as recommended in the CCM catalogue (see http://www.sci.muni.cz)
- Cultures may need at least one subculturing before they can be optimally used in experiments
- Unopened ampoules should be kept in a dark and cool place!

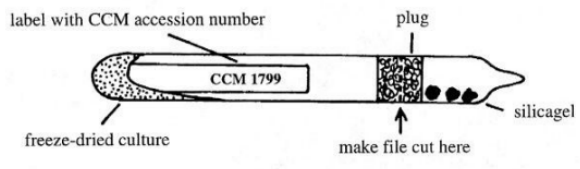

Figure 1: from CCM document 'Instructions for Opening and Reviving of Freeze-Dried Bacteria and Fungi' available on http://www.sci.muni.cz

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SUBCULTURE AND MAINTENANCE OF QUALITY CONTROL STRAINS

1.1 Purpose

Improper storage and repeated subculturing of bacteria can produce alterations in antimicrobial susceptibility test results. The Clinical and Laboratory Standards Institute (CLSI, formerly NCCLS) has published a guideline for Quality Control (QC) stock culture maintenance to ensure consistent antimicrobial susceptibility test results.

1.2 References

M100-S24, January 2014 (Performance Standards for Antimicrobial Susceptibility Testing)

M7-A9, January 2012 (Methods for Dilution Antimicrobial Susceptibility Test for Bacteria That Grow Aerobically; Approved Standard)

1.3 Definition of Terms

Reference Culture: A reference culture is a microorganism preparation that is acquired from a culture type collection.

Reference Stock Culture: A reference stock culture is a microorganism preparation that is derived from a reference culture. Guidelines and standards outline how reference stock cultures must be processed and stored.

Working Stock Cultures: A working stock culture is growth derived from a reference stock culture. Guidelines and standards outline how working stock cultures must be processed and how often they can be subcultured.

Subcultures (Passages): A subculture is simply the transfer of established microorganism growth on media to fresh media. The subsequent growth on the fresh media constitutes a subculture or passage. Growing a reference culture or reference stock culture from its preserved status (frozen or lyophilized) is not a subculture. The preserved microorganism is not in a stage of established growth until it is thawed or hydrated and grown for the first time

1.4 Important Considerations

- Do not use disc diffusion strains for MIC determination.
- Obtain QC strains from a reliable source such as ATCC
- CLSI requires that QC be performed either on the same day or weekly (only after 30 day QC validation)
- Any changes in materials or procedure must be validated with QC before implemented
- For example: Agar and broth methods may give different QC ranges for drugs such as glycopeptides, aminoglycosides and macrolides
- Periodically perform colony counts to check the inoculum preparation procedure

- Ideally, test values should be in the middle of the acceptable range
- Graphing QC data points over time can help identify changes in data helpful for troubleshooting problems

1.5 Storage of Reference Strains

Preparation of stock cultures

- Use a suitable stabilizer such as 50% fetal calf serum in broth, 10-15% glycerol in tryptic soy broth, defibrinated sheep blood or skim milk to prepare multiple aliquots.
- Store at -20°C, -70°C or liquid nitrogen. (Alternatively, freeze dry.)
- Before using rejuvenated strains for QC, subculture to check for purity and viability.

Working cultures

- Set up on agar slants with appropriate medium, store at 4-8°C and subculture weekly.
- Replace the working strain with a stock culture at least monthly.
- If a change in the organisms inherent susceptibility occurs, obtain a fresh stock culture or a new strain from a reference culture collection e.g. ATCC.

1.6 Frequency of Testing

Weekly vs. daily testing

Weekly testing is possible if the lab can demonstrate satisfactory performance with daily testing as follows:

- Documentation showing reference strain results from 30 consecutive test days were within the acceptable range.
- For each antimicrobial/organism combination, no more than 3 out of 30 MIC values may be outside the acceptable range.

When the above are fulfilled, each quality control strain may be tested once a week and whenever any reagent component is changed.

Corrective Actions

If an MIC is outside the range in weekly testing, corrective action is required as follows:

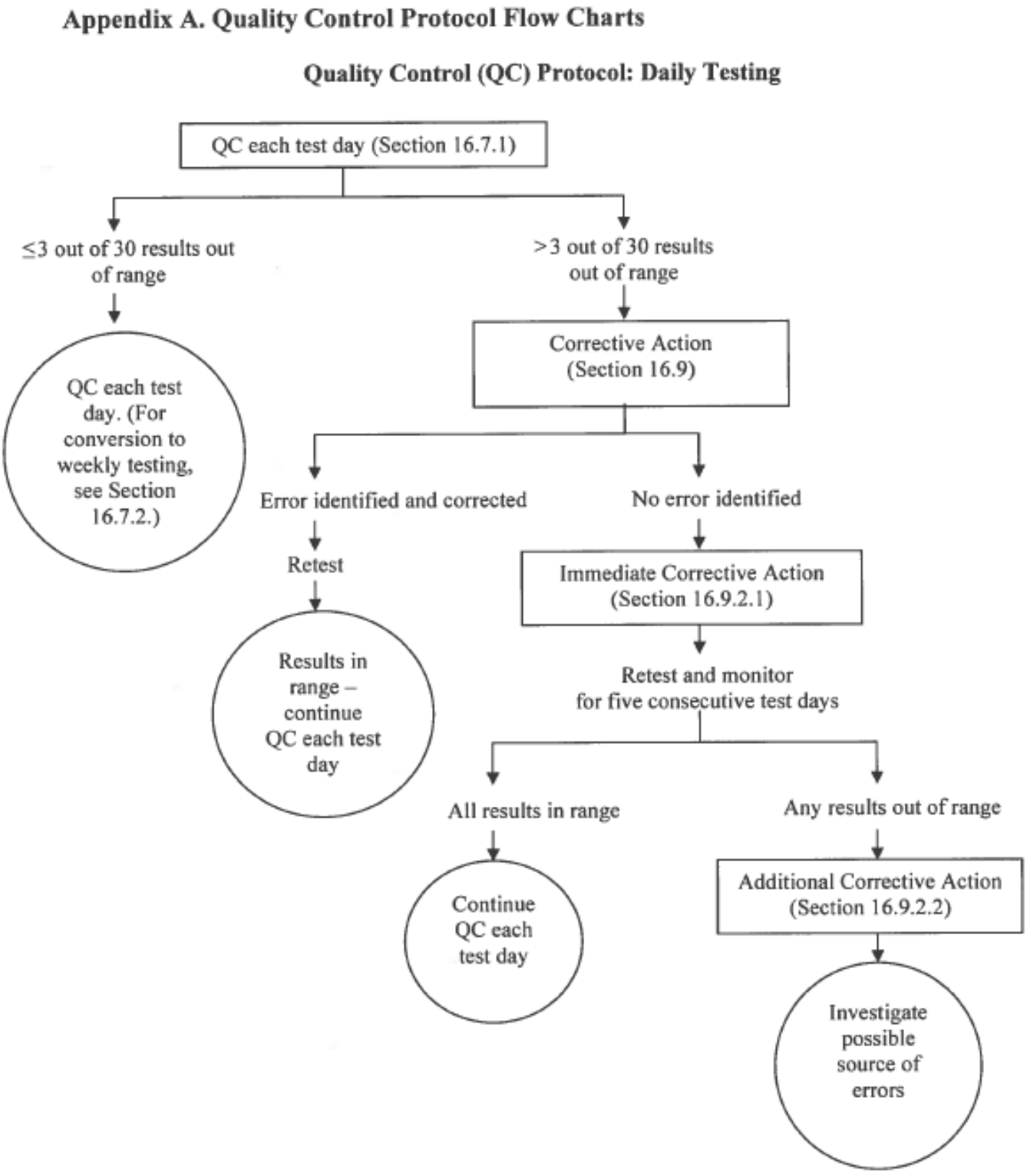
- Repeat the test if there is an obvious error e.g. wrong strain or incubation conditions used
- If there is no obvious error, return to daily control testing

The problem is considered resolved only after the reference strain is tested for 5 consecutive days and each drug/organism result is within specification on each day.

If the problem cannot be resolved, continue daily testing until the errors are identified.

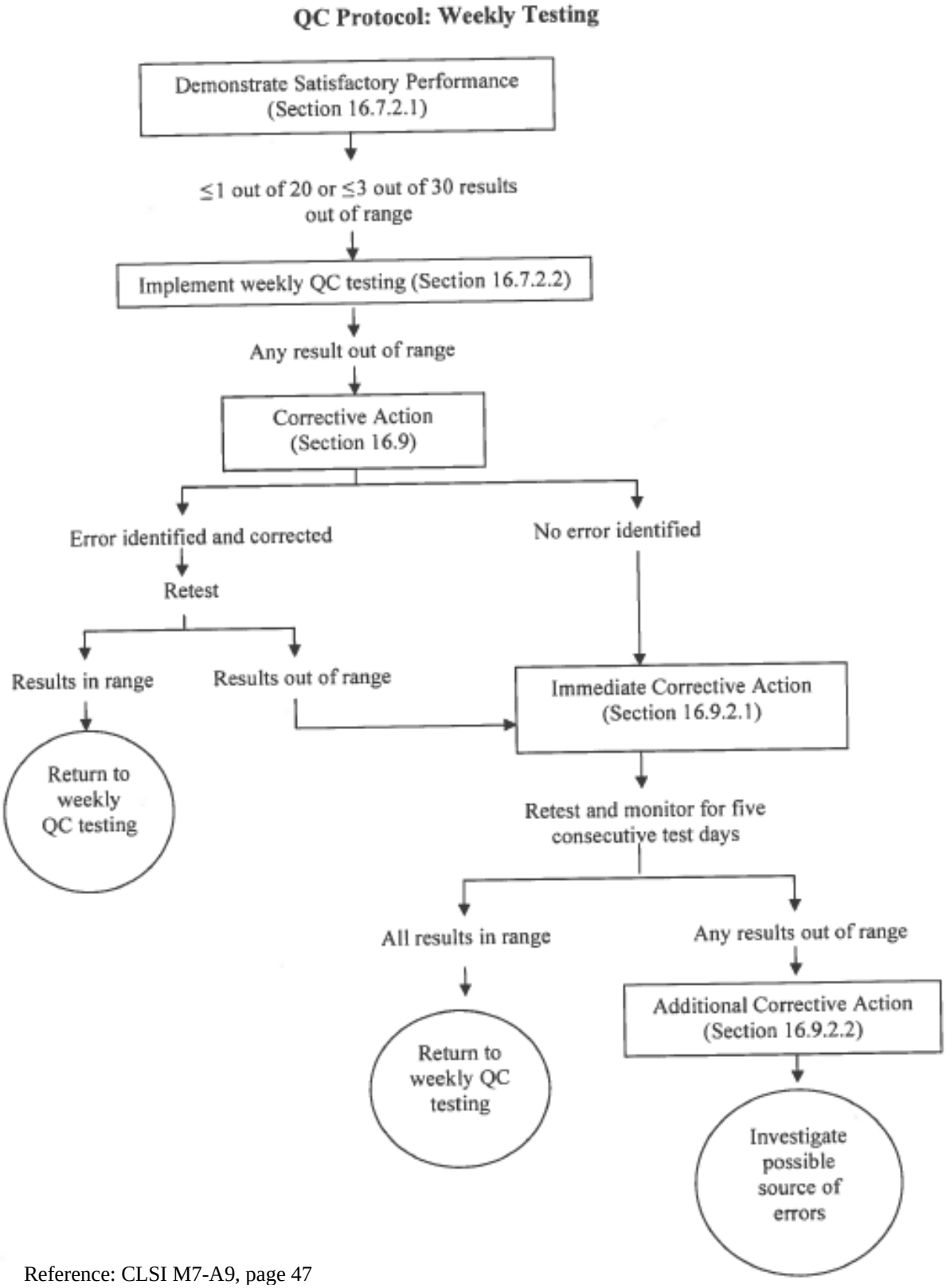
Repeat the 30 days validation before resuming weekly testing.

DAILY MIC QC CHART



Reference: CLSI M7-A9, page 46

Appendix A. (Continued)



Reference: CLSI M7-A9, page 47

Appendix 5

Quality control ranges - *Escherichia coli* ATCC 25922, Panel 1

Antimicrobial	Abbreviation	Min. (µg/ml)	Max. (µg/ml)
Ampicillin	AMP	2	8
Azithromycin	AZI	NA	NA
Cefotaxime	FOT	0.03	0.12
Ceftazidime	TAZ	0.06	0.5
Chloramphenicol	CHL	2	8
Ciprofloxacin	CIP	0.004	0.015
Colistin	COL	0.25	2
Gentamicin	GEN	0.25	1
Meropenem	MER	0.008	0.06
Nalidixic acid	NAL	1	4
Sulfamethoxazole	SMX	8	32
Tetracycline	TET	0.5	2
Tigecycline	TGC	0.03	0.25
Trimethoprim	TMP	0.5	2

Quality control ranges - *Escherichia coli* ATCC 25922, Panel 2

Antimicrobial	Abbreviation	Min. (µg/ml)	Max. (µg/ml)
Cefepime	FEP	0.015	0.12
Cefotaxime/clavulanic acid	F/C	NA	na
Cefotaxime	FOT	0.03	0.12
Cefoxitin	FOX	2	8
Ceftazidime	TAZ	0.06	0.5
Ceftazidime/clavulanic acid	T/C	NA	NA
Ertapenem	ETP	0.004	0.015
Imipenem	IMI	0.06	0.25
Meropenem	MER	0.008	0.06
Temocillin	TRM	NA	NA

Legend

NA, not available

Quality control ranges - *Staphylococcus aureus* ATCC 29213

Antimicrobial	Abbreviation	Min. (µg/ml)	Max. (µg/ml)
Cefoxitin	FOX	1	4
Chloramphenicol	CHL	2	16
Ciprofloxacin	CIP	0.12	0.5
Clindamycin	CLN	0.06	0.25
Erythromycin	ERY	0.25	1
Gentamicin	GEN	0.12	1
Linezolid	LZD	1	4
Mupirocin	MUP	NA	NA
Quinupristin-dalfopristin	SYN	0.25	1
Sulfamethoxazole	SMX	32	128
Sulfamethoxazole-trimethoprim	SXT	0	0.5
Tetracycline	TET	0.12	1
Tiamulin	TIA	NA	NA
Trimethoprim	TMP	1	4
Vancomycin	VAN	0.5	2

Quality control ranges - *Enterococcus faecalis* ATCC 29212

Antimicrobial	Abbreviation	Min. (µg/ml)	Max. (µg/ml)
Ampicillin	AMP	0.5	2
Chloramphenicol	CHL	4	16
Ciprofloxacin	CIP	0.25	2
Daptomycin	DAP	1*	4*
Erythromycin	ERY	1	4
Gentamicin	GEN	4	16
Linezolid	LZD	1	4
Quinupristin-dalfopristin	SYN	2	8
Teicoplanin	TEI	0.25	1
Tetracycline	TET	8	32
Tigecycline	TGC	0.03	0.12
Vancomycin	VAN	1	4

Legend

*when medium is supplemented with calcium to a final concentration of 50 µg/ml

NA, not available

Appendix 6a

Enterococcus faecalis **ATCC 29212 results**

Lab code	Antimicrobial	Abbreviation	Operator	Read_Value	Min. Value	Max. Value	Score
2	Ampicillin	AMP	=	1	0.5	2	1
2	Chloramphenicol	CHL	=	8	4	16	1
2	Ciprofloxacin	CIP	=	1	0.25	2	1
2	Daptomycin	DAP	=	2	1	4	1
2	Erythromycin	ERY	=	2	1	4	1
2	Gentamicin	GEN	<=	8	4	16	1
2	Linezolid	LZD	=	2	1	4	1
2	Teicoplanin	TEI	<=	0.5	0.25	1	1
2	Tetracycline	TET	=	16	8	32	1
2	Tigecycline	TGC	=	0.06	0.03	0.12	1
2	Vancomycin	VAN	=	2	1	4	1
9	Ampicillin	AMP	=	1	0.5	2	1
9	Chloramphenicol	CHL	=	8	4	16	1
9	Ciprofloxacin	CIP	=	1	0.25	2	1
9	Daptomycin	DAP	=	2	1	4	1
9	Erythromycin	ERY	=	2	1	4	1
9	Gentamicin	GEN	<=	8	4	16	1
9	Linezolid	LZD	=	2	1	4	1
9	Teicoplanin	TEI	<=	0.5	0.25	1	1
9	Tetracycline	TET	=	16	8	32	1
9	Tigecycline	TGC	=	0.06	0.03	0.12	1
9	Vancomycin	VAN	=	4	1	4	1
11	Ampicillin	AMP	<=	0.5	0.5	2	1
11	Chloramphenicol	CHL	<=	4	4	16	1
11	Ciprofloxacin	CIP	=	1	0.25	2	1
11	Daptomycin	DAP	=	1	1	4	1
11	Erythromycin	ERY	=	2	1	4	1
11	Gentamicin	GEN	<=	8	4	16	1
11	Linezolid	LZD	=	1	1	4	1
11	Teicoplanin	TEI	<=	0.5	0.25	1	1
11	Tetracycline	TET	=	16	8	32	1
11	Tigecycline	TGC	=	0.06	0.03	0.12	1
11	Vancomycin	VAN	=	2	1	4	1
12	Ampicillin	AMP	=	1	0.5	2	1
12	Chloramphenicol	CHL	<=	4	4	16	1
12	Ciprofloxacin	CIP	=	0.5	0.25	2	1
12	Daptomycin	DAP	=	2	1	4	1
12	Erythromycin	ERY	=	2	1	4	1
12	Gentamicin	GEN	<=	8	4	16	1
12	Linezolid	LZD	=	1	1	4	1
12	Teicoplanin	TEI	<=	0.5	0.25	1	1
12	Tetracycline	TET	=	16	8	32	1
12	Tigecycline	TGC	=	0.06	0.03	0.12	1
12	Vancomycin	VAN	=	2	1	4	1
16	Ampicillin	AMP	=	1	0.5	2	1
16	Chloramphenicol	CHL	=	8	4	16	1
16	Ciprofloxacin	CIP	=	1	0.25	2	1
16	Daptomycin	DAP	=	2	1	4	1
16	Erythromycin	ERY	=	2	1	4	1
16	Gentamicin	GEN	=	16	4	16	1
16	Linezolid	LZD	=	2	1	4	1
16	Teicoplanin	TEI	<=	0.5	0.25	1	1
16	Tetracycline	TET	=	32	8	32	1
16	Tigecycline	TGC	=	0.12	0.03	0.12	1
16	Vancomycin	VAN	=	2	1	4	1
17	Ampicillin	AMP	=	2	0.5	2	1
17	Chloramphenicol	CHL	=	8	4	16	1
17	Ciprofloxacin	CIP	=	1	0.25	2	1
17	Daptomycin	DAP	=	2	1	4	1

17	Erythromycin	ERY	=	2	1	4	1
17	Gentamicin	GEN	<=	8	4	16	1
17	Linezolid	LZD	=	2	1	4	1
17	Teicoplanin	TEI	<=	0.5	0.25	1	1
17	Tetracycline	TET	=	16	8	32	1
17	Tigecycline	TGC	=	0.12	0.03	0.12	1
17	Vancomycin	VAN	=	4	1	4	1
20	Ampicillin	AMP	=	1	0.5	2	1
20	Chloramphenicol	CHL	=	8	4	16	1
20	Ciprofloxacin	CIP	=	1	0.25	2	1
20	Daptomycin	DAP	=	4	1	4	1
20	Erythromycin	ERY	=	2	1	4	1
20	Gentamicin	GEN	<=	8	4	16	1
20	Linezolid	LZD	=	2	1	4	1
20	Teicoplanin	TEI	<=	0.5	0.25	1	1
20	Tetracycline	TET	=	32	8	32	1
20	Tigecycline	TGC	=	0.12	0.03	0.12	1
20	Vancomycin	VAN	=	4	1	4	1
21	Chloramphenicol	CHL	=	8	4	16	1
21	Ciprofloxacin	CIP	=	1	0.25	2	1
21	Erythromycin	ERY	<=	1	1	4	1
21	Gentamicin	GEN	<=	4	4	16	1
21	Linezolid	LZD	=	2	1	4	1
21	Tetracycline	TET	=	8	8	32	1
21	Vancomycin	VAN	<=	1	1	4	1
22	Ampicillin	AMP	=	2	0.5	2	1
22	Chloramphenicol	CHL	=	8	4	16	1
22	Ciprofloxacin	CIP	=	1	0.25	2	1
22	Daptomycin	DAP	=	2	1	4	1
22	Erythromycin	ERY	=	4	1	4	1
22	Gentamicin	GEN	<=	8	4	16	1
22	Linezolid	LZD	=	2	1	4	1
22	Teicoplanin	TEI	<=	0.5	0.25	1	1
22	Tetracycline	TET	=	32	8	32	1
22	Tigecycline	TGC	<=	0.12	0.03	0.12	1
22	Vancomycin	VAN	=	4	1	4	1
23	Ampicillin	AMP	<=	0.5	0.5	2	1
23	Chloramphenicol	CHL	<=	4	4	16	1
23	Ciprofloxacin	CIP	=	0.5	0.25	2	1
23	Daptomycin	DAP	=	1	1	4	1
23	Erythromycin	ERY	=	2	1	4	1
23	Gentamicin	GEN	<=	8	4	16	1
23	Linezolid	LZD	=	1	1	4	1
23	Teicoplanin	TEI	<=	0.5	0.25	1	1
23	Tetracycline	TET	=	16	8	32	1
23	Tigecycline	TGC	<=	0.03	0.03	0.12	1
23	Vancomycin	VAN	<=	1	1	4	1
25	Ampicillin	AMP	=	1	0.5	2	1
25	Chloramphenicol	CHL	=	8	4	16	1
25	Ciprofloxacin	CIP	=	1	0.25	2	1
25	Daptomycin	DAP	=	4	1	4	1
25	Erythromycin	ERY	=	2	1	4	1
25	Gentamicin	GEN	=	16	4	16	1
25	Linezolid	LZD	=	2	1	4	1
25	Teicoplanin	TEI	<=	0.5	0.25	1	1
25	Tetracycline	TET	=	16	8	32	1
25	Tigecycline	TGC	=	0.12	0.03	0.12	1
25	Vancomycin	VAN	=	4	1	4	1
26	Ampicillin	AMP	=	1	0.5	2	1
26	Chloramphenicol	CHL	=	8	4	16	1
26	Ciprofloxacin	CIP	=	1	0.25	2	1

26	Daptomycin	DAP	=	2	1	4	1
26	Erythromycin	ERY	=	2	1	4	1
26	Gentamicin	GEN	<=	8	4	16	1
26	Linezolid	LZD	=	2	1	4	1
26	Teicoplanin	TEI	<=	0.5	0.25	1	1
26	Tetracycline	TET	=	16	8	32	1
26	Tigecycline	TGC	=	0.06	0.03	0.12	1
26	Vancomycin	VAN	<=	1	1	4	1
29	Ampicillin	AMP		1	0.5	2	1
29	Chloramphenicol	CHL		8	4	16	1
29	Ciprofloxacin	CIP		0.5	0.25	2	1
29	Daptomycin	DAP		2	1	4	1
29	Erythromycin	ERY	<=	1	1	4	1
29	Gentamicin	GEN	<=	8	4	16	1
29	Linezolid	LZD		2	1	4	1
29	Teicoplanin	TEI	<=	0.5	0.25	1	1
29	Tetracycline	TET		32	8	32	1
29	Tigecycline	TGC		0.06	0.03	0.12	1
29	Vancomycin	VAN		4	1	4	1
30	Ampicillin	AMP	=	1	0.5	2	1
30	Chloramphenicol	CHL	<=	4	4	16	1
30	Ciprofloxacin	CIP	=	0.5	0.25	2	1
30	Daptomycin	DAP	=	1	1	4	1
30	Erythromycin	ERY	=	2	1	4	1
30	Gentamicin	GEN	<=	8	4	16	1
30	Linezolid	LZD	=	2	1	4	1
30	Teicoplanin	TEI	<=	0.5	0.25	1	1
30	Tetracycline	TET	=	16	8	32	1
30	Tigecycline	TGC	=	0.06	0.03	0.12	1
30	Vancomycin	VAN	=	2	1	4	1
32	Ampicillin	AMP	=	1	0.5	2	1
32	Chloramphenicol	CHL	=	8	4	16	1
32	Ciprofloxacin	CIP	=	0.5	0.25	2	1
32	Daptomycin	DAP	=	2	1	4	1
32	Erythromycin	ERY	=	2	1	4	1
32	Gentamicin	GEN	<=	8	4	16	1
32	Linezolid	LZD	=	2	1	4	1
32	Teicoplanin	TEI	<=	0.5	0.25	1	1
32	Tetracycline	TET	=	32	8	32	1
32	Tigecycline	TGC	=	0.06	0.03	0.12	1
32	Vancomycin	VAN	=	4	1	4	1
33	Ampicillin	AMP	=	1	0.5	2	1
33	Chloramphenicol	CHL	=	4	4	16	1
33	Erythromycin	ERY	=	2	1	4	1
33	Gentamicin	GEN	=	8	4	16	1
33	Linezolid	LZD	=	1	1	4	1
33	Tetracycline	TET	=	16	8	32	1
33	Vancomycin	VAN	=	2	1	4	1
34	Ampicillin	AMP	=	1	0.5	2	1
34	Chloramphenicol	CHL	=	8	4	16	1
34	Ciprofloxacin	CIP	=	1	0.25	2	1
34	Daptomycin	DAP	=	2	1	4	1
34	Erythromycin	ERY	=	4	1	4	1
34	Gentamicin	GEN	<=	8	4	16	1
34	Linezolid	LZD	=	2	1	4	1
34	Teicoplanin	TEI	<=	0.5	0.25	1	1
34	Tetracycline	TET	=	32	8	32	1
34	Tigecycline	TGC	=	0.12	0.03	0.12	1
34	Vancomycin	VAN	=	4	1	4	1
36	Ampicillin	AMP	=	1	0.5	2	1
36	Chloramphenicol	CHL	=	8	4	16	1

36	Ciprofloxacin	CIP	=	1	0.25	2	1
36	Daptomycin	DAP	=	2	1	4	1
36	Erythromycin	ERY	=	2	1	4	1
36	Gentamicin	GEN	<=	8	4	16	1
36	Linezolid	LZD	=	2	1	4	1
36	Teicoplanin	TEI	<=	0.5	0.25	1	1
36	Tetracycline	TET	=	16	8	32	1
36	Tigecycline	TGC	=	0.12	0.03	0.12	1
36	Vancomycin	VAN	=	2	1	4	1
37	Ampicillin	AMP	<=	0.5	0.5	2	1
37	Chloramphenicol	CHL	=	4	4	16	1
37	Ciprofloxacin	CIP	=	0.5	0.25	2	1
37	Erythromycin	ERY	<=	1	1	4	1
37	Gentamicin	GEN	<=	8	4	16	1
37	Linezolid	LZD	=	2	1	4	1
37	Tetracycline	TET	=	16	8	32	1
37	Tigecycline	TGC	=	0.12	0.03	0.12	1
37	Vancomycin	VAN	=	4	1	4	1
39	Ampicillin	AMP	=	1	0.5	2	1
39	Chloramphenicol	CHL	<=	4	4	16	1
39	Ciprofloxacin	CIP	=	1	0.25	2	1
39	Daptomycin	DAP	=	2	1	4	1
39	Erythromycin	ERY	=	2	1	4	1
39	Gentamicin	GEN	<=	8	4	16	1
39	Linezolid	LZD	=	2	1	4	1
39	Teicoplanin	TEI	<=	0.5	0.25	1	1
39	Tetracycline	TET	=	32	8	32	1
39	Tigecycline	TGC	=	0.12	0.03	0.12	1
39	Vancomycin	VAN	=	4	1	4	1
40	Ampicillin	AMP	=	1	0.5	2	1
40	Chloramphenicol	CHL	=	4	4	16	1
40	Ciprofloxacin	CIP	=	0.5	0.25	2	1
40	Daptomycin	DAP	=	1	1	4	1
40	Erythromycin	ERY	=	1	1	4	1
40	Gentamicin	GEN	=	16	4	16	1
40	Linezolid	LZD	=	1	1	4	1
40	Teicoplanin	TEI	=	0.5	0.25	1	1
40	Tetracycline	TET	=	8	8	32	1
40	Tigecycline	TGC	=	0.06	0.03	0.12	1
40	Vancomycin	VAN	=	1	1	4	1
42	Ampicillin	AMP	=	1	0.5	2	1
42	Chloramphenicol	CHL	<=	4	4	16	1
42	Ciprofloxacin	CIP	=	1	0.25	2	1
42	Daptomycin	DAP	=	2	1	4	1
42	Erythromycin	ERY	=	2	1	4	1
42	Gentamicin	GEN	<=	8	4	16	1
42	Linezolid	LZD	=	2	1	4	1
42	Teicoplanin	TEI	<=	0.5	0.25	1	1
42	Tetracycline	TET	=	16	8	32	1
42	Tigecycline	TGC	=	0.06	0.03	0.12	1
42	Vancomycin	VAN	=	2	1	4	1
45	Ampicillin	AMP	=	2	0.5	2	1
45	Chloramphenicol	CHL	=	8	4	16	1
45	Ciprofloxacin	CIP	=	0.25	0.25	2	1
45	Daptomycin	DAP	=	1	1	4	1
45	Erythromycin	ERY	<=	1	1	4	1
45	Gentamicin	GEN	<=	8	4	16	1
45	Linezolid	LZD	=	2	1	4	1
45	Teicoplanin	TEI	<=	0.5	0.25	1	1
45	Tetracycline	TET	=	32	8	32	1
45	Tigecycline	TGC	=	0.25	0.03	0.12	0

45	Vancomycin	VAN	=	4	1	4	1
56	Ampicillin	AMP	=	1	0.5	2	1
56	Chloramphenicol	CHL	=	8	4	16	1
56	Ciprofloxacin	CIP	=	0.5	0.25	2	1
56	Daptomycin	DAP	=	2	1	4	1
56	Erythromycin	ERY	=	2	1	4	1
56	Gentamicin	GEN	<=	8	4	16	1
56	Linezolid	LZD	=	2	1	4	1
56	Teicoplanin	TEI	<=	0.5	0.25	1	1
56	Tetracycline	TET	=	16	8	32	1
56	Tigecycline	TGC	=	0.12	0.03	0.12	1
56	Vancomycin	VAN	=	2	1	4	1
58	Ampicillin	AMP	=	1	0.5	2	1
58	Chloramphenicol	CHL	=	8	4	16	1
58	Ciprofloxacin	CIP	=	1	0.25	2	1
58	Daptomycin	DAP	=	4	1	4	1
58	Erythromycin	ERY	=	2	1	4	1
58	Gentamicin	GEN	<=	8	4	16	1
58	Linezolid	LZD	=	2	1	4	1
58	Teicoplanin	TEI	<=	0.5	0.25	1	1
58	Tetracycline	TET	=	16	8	32	1
58	Tigecycline	TGC	=	0.12	0.03	0.12	1
58	Vancomycin	VAN	=	4	1	4	1
59	Ampicillin	AMP	<=	0.5	0.5	2	1
59	Chloramphenicol	CHL	<=	4	4	16	1
59	Ciprofloxacin	CIP	=	0.5	0.25	2	1
59	Daptomycin	DAP	<=	0.25	1	4	0
59	Erythromycin	ERY	=	2	1	4	1
59	Gentamicin	GEN	<=	8	4	16	1
59	Linezolid	LZD	<=	0.5	1	4	0
59	Teicoplanin	TEI	<=	0.5	0.25	1	1
59	Tetracycline	TET	=	16	8	32	1
59	Tigecycline	TGC	=	0.06	0.03	0.12	1
59	Vancomycin	VAN	<=	1	1	4	1
60	Ampicillin	AMP	=	1	0.5	2	1
60	Chloramphenicol	CHL	=	8	4	16	1
60	Ciprofloxacin	CIP	=	1	0.25	2	1
60	Daptomycin	DAP	=	4	1	4	1
60	Erythromycin	ERY	=	2	1	4	1
60	Gentamicin	GEN	=	16	4	16	1
60	Linezolid	LZD	=	2	1	4	1
60	Teicoplanin	TEI	<=	0.5	0.25	1	1
60	Tetracycline	TET	=	16	8	32	1
60	Tigecycline	TGC	=	0.12	0.03	0.12	1
60	Vancomycin	VAN	=	4	1	4	1

Appendix 6b

Staphylococcus aureus **ATCC 29213 results**

Lab code	Antimicrobial	Operator	Read_Value	Min. Value	Max. Value	Score
2	Cefoxitin FOX	=	4	1	4	1
2	Chloramphenicol CHL	<=	4	2	16	1
2	Ciprofloxacin CIP	<=	0.25	0.12	0.5	1
2	Clindamycin CLN	<=	0.12	0.06	0.25	1
2	Erythromycin ERY	=	0.5	0.25	1	1
2	Gentamicin GEN	<=	1	0.12	1	1
2	Linezolid LZD	<=	1	1	4	1
2	Quinupristin/dalfopristin (Synercid) SYN	<=	0.5	0.25	1	1
2	Sulfamethoxazole SMX	<=	64	32	128	1
2	Tetracycline TET	<=	0.5	0.12	1	1
2	Trimethoprim TMP	<=	2	1	4	1
2	Vancomycin VAN	<=	1	0.5	2	1
4	Cefoxitin FOX	=	4	1	4	1
4	Chloramphenicol CHL	=	8	2	16	1
4	Ciprofloxacin CIP	<=	0.25	0.12	0.5	1
4	Clindamycin CLN	<=	0.12	0.06	0.25	1
4	Erythromycin ERY	=	0.5	0.25	1	1
4	Gentamicin GEN	<=	1	0.12	1	1
4	Linezolid LZD	=	2	1	4	1
4	Quinupristin/dalfopristin (Synercid) SYN	<=	0.5	0.25	1	1
4	Sulfamethoxazole SMX	<=	64	32	128	1
4	Tetracycline TET	<=	0.5	0.12	1	1
4	Trimethoprim TMP	<=	2	1	4	1
4	Vancomycin VAN	<=	1	0.5	2	1
9	Cefoxitin FOX	=	2	1	4	1
9	Chloramphenicol CHL	<=	4	2	16	1
9	Ciprofloxacin CIP	<=	0.25	0.12	0.5	1
9	Clindamycin CLN	<=	0.12	0.06	0.25	1
9	Erythromycin ERY	=	0.5	0.25	1	1
9	Gentamicin GEN	<=	1	0.12	1	1
9	Linezolid LZD	=	2	1	4	1
9	Quinupristin/dalfopristin (Synercid) SYN	<=	0.5	0.25	1	1
9	Sulfamethoxazole SMX	<=	64	32	128	1
9	Tetracycline TET	<=	0.5	0.12	1	1
9	Trimethoprim TMP	<=	2	1	4	1
9	Vancomycin VAN	<=	1	0.5	2	1
11	Cefoxitin FOX	=	4	1	4	1
11	Chloramphenicol CHL	=	8	2	16	1
11	Ciprofloxacin CIP	=	0.5	0.12	0.5	1
11	Clindamycin CLN	=	0.25	0.06	0.25	1
11	Erythromycin ERY	=	0.5	0.25	1	1
11	Gentamicin GEN	<=	1	0.12	1	1
11	Linezolid LZD	=	4	1	4	1
11	Quinupristin/dalfopristin (Synercid) SYN	<=	0.5	0.25	1	1
11	Sulfamethoxazole SMX	=	128	32	128	1
11	Tetracycline TET	=	1	0.12	1	1
11	Trimethoprim TMP	<=	2	1	4	1
11	Vancomycin VAN	<=	1	0.5	2	1
12	Cefoxitin FOX	=	4	1	4	1
12	Chloramphenicol CHL	=	8	2	16	1
12	Ciprofloxacin CIP	<=	0.25	0.12	0.5	1
12	Clindamycin CLN	<=	0.12	0.06	0.25	1
12	Erythromycin ERY	=	0.5	0.25	1	1
12	Gentamicin GEN	<=	1	0.12	1	1
12	Linezolid LZD	=	2	1	4	1
12	Quinupristin/dalfopristin (Synercid) SYN	<=	0.5	0.25	1	1
12	Sulfamethoxazole SMX	<=	64	32	128	1
12	Tetracycline TET	<=	0.5	0.12	1	1

12	Trimethoprim TMP	<=	2	1	4	1
12	Vancomycin VAN	<=	1	0.5	2	1
17	Cefoxitin FOX	<=	4	1	4	1
17	Chloramphenicol CHL	=	8	2	16	1
17	Ciprofloxacin CIP	<=	0.25	0.12	0.5	1
17	Clindamycin CLN	<=	0.12	0.06	0.25	1
17	Erythromycin ERY	=	0.5	0.25	1	1
17	Gentamicin GEN	<=	1	0.12	1	1
17	Linezolid LZD	=	2	1	4	1
17	Quinupristin/dalfopristin (Synercid) SYN	<=	0.5	0.25	1	1
17	Sulfamethoxazole SMX	<=	64	32	128	1
17	Tetracycline TET	<=	0.5	0.12	1	1
17	Trimethoprim TMP	<=	2	1	4	1
17	Vancomycin VAN	<=	1	0.5	2	1
18	Cefoxitin FOX	=	4	1	4	1
18	Chloramphenicol CHL	=	8	2	16	1
18	Ciprofloxacin CIP	=	0.5	0.12	0.5	1
18	Clindamycin CLN	<=	0.12	0.06	0.25	1
18	Erythromycin ERY	=	0.5	0.25	1	1
18	Gentamicin GEN	<=	1	0.12	1	1
18	Linezolid LZD	=	2	1	4	1
18	Quinupristin/dalfopristin (Synercid) SYN	<=	0.5	0.25	1	1
18	Sulfamethoxazole SMX	>	512	32	128	0
18	Tetracycline TET	<=	0.5	0.12	1	1
18	Trimethoprim TMP	<=	2	1	4	1
18	Vancomycin VAN	<=	1	0.5	2	1
20	Cefoxitin FOX	=	4	1	4	1
20	Chloramphenicol CHL	=	16	2	16	1
20	Ciprofloxacin CIP	<=	0.25	0.12	0.5	1
20	Clindamycin CLN	<=	0.12	0.06	0.25	1
20	Erythromycin ERY	=	0.5	0.25	1	1
20	Gentamicin GEN	<=	1	0.12	1	1
20	Linezolid LZD	=	4	1	4	1
20	Quinupristin/dalfopristin (Synercid) SYN	<=	0.5	0.25	1	1
20	Sulfamethoxazole SMX	<=	64	32	128	1
20	Tetracycline TET	=	1	0.12	1	1
20	Trimethoprim TMP	<=	2	1	4	1
20	Vancomycin VAN	<=	1	0.5	2	1
21	Cefoxitin FOX	=	4	1	4	1
21	Chloramphenicol CHL	=	8	2	16	1
21	Ciprofloxacin CIP	<=	0.25	0.12	0.5	1
21	Clindamycin CLN	<=	0.12	0.06	0.25	1
21	Erythromycin ERY	=	0.5	0.25	1	1
21	Gentamicin GEN	<=	1	0.12	1	1
21	Linezolid LZD	=	2	1	4	1
21	Quinupristin/dalfopristin (Synercid) SYN	<=	0.5	0.25	1	1
21	Sulfamethoxazole SMX	<=	64	32	128	1
21	Tetracycline TET	<=	0.5	0.12	1	1
21	Trimethoprim TMP	<=	2	1	4	1
21	Vancomycin VAN	<=	1	0.5	2	1
22	Cefoxitin FOX	=	4	1	4	1
22	Chloramphenicol CHL	=	8	2	16	1
22	Ciprofloxacin CIP	<=	0.25	0.12	0.5	1
22	Clindamycin CLN	<=	0.12	0.06	0.25	1
22	Erythromycin ERY	=	0.5	0.25	1	1
22	Gentamicin GEN	<=	1	0.12	1	1
22	Linezolid LZD	=	2	1	4	1
22	Quinupristin/dalfopristin (Synercid) SYN	<=	0.5	0.25	1	1
22	Sulfamethoxazole SMX	<=	64	32	128	1
22	Tetracycline TET	<=	0.5	0.12	1	1

22	Trimethoprim TMP	<=	2	1	4	1
22	Vancomycin VAN	<=	1	0.5	2	1
23	Cefoxitin FOX		4	1	4	1
23	Chloramphenicol CHL		8	2	16	1
23	Ciprofloxacin CIP	<=	0.25	0.12	0.5	1
23	Clindamycin CLN	<=	0.12	0.06	0.25	1
23	Erythromycin ERY		0.5	0.25	1	1
23	Gentamicin GEN	<=	1	0.12	1	1
23	Linezolid LZD		2	1	4	1
23	Quinupristin/dalfopristin (Synercid) SYN	<=	0.5	0.25	1	1
23	Sulfamethoxazole SMX	<=	64	32	128	1
23	Tetracycline TET	<=	0.5	0.12	1	1
23	Trimethoprim TMP	<=	2	1	4	1
23	Vancomycin VAN	<=	1	0.5	2	1
25	Clindamycin CLN	=	0.12	0.06	0.25	1
25	Erythromycin ERY	=	0.5	0.25	1	1
25	Sulfamethoxazole-Trimethoprim SXT	<=	0.12	0	0.5	1
25	Tetracycline TET	=	0.5	0.12	1	1
26	Cefoxitin FOX	=	4	1	4	1
26	Chloramphenicol CHL	=	8	2	16	1
26	Ciprofloxacin CIP	<=	0.25	0.12	0.5	1
26	Clindamycin CLN	<=	0.12	0.06	0.25	1
26	Erythromycin ERY	=	0.5	0.25	1	1
26	Gentamicin GEN	<=	1	0.12	1	1
26	Linezolid LZD	=	2	1	4	1
26	Quinupristin/dalfopristin (Synercid) SYN	<=	0.5	0.25	1	1
26	Sulfamethoxazole SMX	<=	64	32	128	1
26	Sulfamethoxazole-Trimethoprim SXT	<=	0.12	0	0.5	1
26	Tetracycline TET	<=	0.5	0.12	1	1
26	Trimethoprim TMP	<=	2	1	4	1
26	Vancomycin VAN	<=	1	0.5	2	1
29	Cefoxitin FOX	=	4	1	4	1
29	Chloramphenicol CHL	=	8	2	16	1
29	Ciprofloxacin CIP	<=	0.25	0.12	0.5	1
29	Clindamycin CLN	<=	0.12	0.06	0.25	1
29	Erythromycin ERY	<=	0.25	0.25	1	1
29	Gentamicin GEN	<=	1	0.12	1	1
29	Linezolid LZD	<=	2	1	4	1
29	Quinupristin/dalfopristin (Synercid) SYN	<=	0.5	0.25	1	1
29	Sulfamethoxazole SMX	<=	64	32	128	1
29	Tetracycline TET	<=	0.5	0.12	1	1
29	Trimethoprim TMP	<=	2	1	4	1
29	Vancomycin VAN	<=	1	0.5	2	1
30	Cefoxitin FOX	=	4	1	4	1
30	Chloramphenicol CHL	<=	4	2	16	1
30	Ciprofloxacin CIP	<=	0.25	0.12	0.5	1
30	Clindamycin CLN	<=	0.12	0.06	0.25	1
30	Erythromycin ERY	<=	0.25	0.25	1	1
30	Gentamicin GEN	<=	1	0.12	1	1
30	Linezolid LZD	=	2	1	4	1
30	Quinupristin/dalfopristin (Synercid) SYN	<=	0.5	0.25	1	1
30	Sulfamethoxazole SMX	<=	64	32	128	1
30	Tetracycline TET	<=	0.5	0.12	1	1
30	Trimethoprim TMP	<=	2	1	4	1
30	Vancomycin VAN	<=	1	0.5	2	1
31	Cefoxitin FOX	<=	4	1	4	1
31	Chloramphenicol CHL	<=	16	2	16	1
31	Ciprofloxacin CIP	=	0.25	0.12	0.5	1
31	Clindamycin CLN	<=	0.25	0.06	0.25	1
31	Erythromycin ERY	<=	0.5	0.25	1	1

31	Gentamicin GEN	<=	2	0.12	1	1
31	Linezolid LZD	<=	1	1	4	1
31	Quinupristin/dalfopristin (Synercid) SYN	<=	1	0.25	1	1
31	Sulfamethoxazole SMX	<=	128	32	128	1
31	Sulfamethoxazole-Trimethoprim SXT	<=	0.5	0	0.5	1
31	Tetracycline TET	<=	1	0.12	1	1
31	Trimethoprim TMP	<=	2	1	4	1
31	Vancomycin VAN	<=	2	0.5	2	1
33	Cefoxitin FOX	=	1	1	4	1
33	Chloramphenicol CHL	=	8	2	16	1
33	Ciprofloxacin CIP	=	0.25	0.12	0.5	1
33	Clindamycin CLN	<=	0.25	0.06	0.25	1
33	Erythromycin ERY	=	0.5	0.25	1	1
33	Gentamicin GEN	=	0.25	0.12	1	1
33	Sulfamethoxazole-Trimethoprim SXT	<=	0.12	0	0.5	1
33	Tetracycline TET	<=	0.5	0.12	1	1
33	Trimethoprim TMP	=	2	1	4	1
34	Cefoxitin FOX	=	4	1	4	1
34	Chloramphenicol CHL	=	8	2	16	1
34	Ciprofloxacin CIP	=	0.5	0.12	0.5	1
34	Clindamycin CLN	<=	0.12	0.06	0.25	1
34	Erythromycin ERY	=	0.5	0.25	1	1
34	Gentamicin GEN	<=	1	0.12	1	1
34	Linezolid LZD	=	2	1	4	1
34	Quinupristin/dalfopristin (Synercid) SYN	<=	0.5	0.25	1	1
34	Sulfamethoxazole SMX	<=	64	32	128	1
34	Tetracycline TET	=	0.5	0.12	1	1
34	Trimethoprim TMP	<=	2	1	4	1
34	Vancomycin VAN	<=	1	0.5	2	1
36	Cefoxitin FOX	=	4	1	4	1
36	Chloramphenicol CHL	=	8	2	16	1
36	Ciprofloxacin CIP	<=	0.25	0.12	0.5	1
36	Clindamycin CLN	<=	0.12	0.06	0.25	1
36	Erythromycin ERY	=	0.5	0.25	1	1
36	Gentamicin GEN	<=	1	0.12	1	1
36	Linezolid LZD	=	2	1	4	1
36	Quinupristin/dalfopristin (Synercid) SYN	<=	0.5	0.25	1	1
36	Sulfamethoxazole SMX	<=	64	32	128	1
36	Tetracycline TET	<=	0.5	0.12	1	1
36	Trimethoprim TMP	<=	2	1	4	1
36	Vancomycin VAN	<=	1	0.5	2	1
37	Cefoxitin FOX	=	4	1	4	1
37	Chloramphenicol CHL	=	8	2	16	1
37	Ciprofloxacin CIP	=	0.5	0.12	0.5	1
37	Erythromycin ERY	=	0.5	0.25	1	1
37	Gentamicin GEN	=	0.25	0.12	1	1
37	Linezolid LZD	=	2	1	4	1
37	Sulfamethoxazole SMX	<=	8	32	128	0
37	Tetracycline TET	=	0.5	0.12	1	1
37	Trimethoprim TMP	=	0.5	1	4	0
37	Vancomycin VAN	<=	1	0.5	2	1
39	Cefoxitin FOX	=	2	1	4	1
39	Chloramphenicol CHL	=	8	2	16	1
39	Ciprofloxacin CIP	<=	0.25	0.12	0.5	1
39	Clindamycin CLN	<=	0.12	0.06	0.25	1
39	Erythromycin ERY	=	0.5	0.25	1	1
39	Gentamicin GEN	<=	1	0.12	1	1
39	Linezolid LZD	=	2	1	4	1
39	Quinupristin/dalfopristin (Synercid) SYN	<=	0.5	0.25	1	1
39	Sulfamethoxazole SMX	<=	64	32	128	1

39	Tetracycline TET	<=	0.5	0.12	1	1
39	Trimethoprim TMP	<=	2	1	4	1
39	Vancomycin VAN	<=	1	0.5	2	1
40	Cefoxitin FOX	=	2	1	4	1
40	Chloramphenicol CHL	=	8	2	16	1
40	Ciprofloxacin CIP	=	0.25	0.12	0.5	1
40	Clindamycin CLN	=	0.12	0.06	0.25	1
40	Erythromycin ERY	=	0.5	0.25	1	1
40	Gentamicin GEN	=	1	0.12	1	1
40	Linezolid LZD	=	2	1	4	1
40	Sulfamethoxazole SMX	=	128	32	128	1
40	Tetracycline TET	=	0.5	0.12	1	1
40	Trimethoprim TMP	=	4	1	4	1
40	Vancomycin VAN	=	1	0.5	2	1
42	Cefoxitin FOX	=	4	1	4	1
42	Chloramphenicol CHL	=	8	2	16	1
42	Ciprofloxacin CIP	<=	0.25	0.12	0.5	1
42	Clindamycin CLN	<=	0.12	0.06	0.25	1
42	Erythromycin ERY	=	0.5	0.25	1	1
42	Gentamicin GEN	<=	1	0.12	1	1
42	Linezolid LZD	=	2	1	4	1
42	Quinupristin/dalfopristin (Synercid) SYN	<=	0.5	0.25	1	1
42	Sulfamethoxazole SMX	<=	64	32	128	1
42	Tetracycline TET	<=	0.5	0.12	1	1
42	Trimethoprim TMP	<=	2	1	4	1
42	Vancomycin VAN	<=	1	0.5	2	1
45	Cefoxitin FOX	=	4	1	4	1
45	Chloramphenicol CHL	=	8	2	16	1
45	Ciprofloxacin CIP	=	0.5	0.12	0.5	1
45	Clindamycin CLN	<=	0.12	0.06	0.25	1
45	Erythromycin ERY	<=	0.25	0.25	1	1
45	Gentamicin GEN	<=	1	0.12	1	1
45	Linezolid LZD	=	4	1	4	1
45	Quinupristin/dalfopristin (Synercid) SYN	=	1	0.25	1	1
45	Sulfamethoxazole SMX	=	128	32	128	1
45	Tetracycline TET	=	1	0.12	1	1
45	Trimethoprim TMP	<=	2	1	4	1
45	Vancomycin VAN	<=	1	0.5	2	1
56	Cefoxitin FOX	=	2	1	4	1
56	Chloramphenicol CHL	=	8	2	16	1
56	Ciprofloxacin CIP	<=	0.25	0.12	0.5	1
56	Clindamycin CLN	<=	0.12	0.06	0.25	1
56	Erythromycin ERY	=	0.5	0.25	1	1
56	Gentamicin GEN	<=	1	0.12	1	1
56	Linezolid LZD	=	2	1	4	1
56	Quinupristin/dalfopristin (Synercid) SYN	<=	0.5	0.25	1	1
56	Sulfamethoxazole SMX	<=	64	32	128	1
56	Tetracycline TET	<=	0.5	0.12	1	1
56	Trimethoprim TMP	<=	2	1	4	1
56	Vancomycin VAN	<=	1	0.5	2	1
58	Cefoxitin FOX	=	4	1	4	1
58	Chloramphenicol CHL	=	8	2	16	1
58	Ciprofloxacin CIP	<=	0.25	0.12	0.5	1
58	Clindamycin CLN	<=	0.12	0.06	0.25	1
58	Erythromycin ERY	=	0.5	0.25	1	1
58	Gentamicin GEN	<=	1	0.12	1	1
58	Linezolid LZD	=	2	1	4	1
58	Quinupristin/dalfopristin (Synercid) SYN	<=	0.5	0.25	1	1
58	Sulfamethoxazole SMX	<=	64	32	128	1
58	Tetracycline TET	<=	0.5	0.12	1	1

58	Trimethoprim TMP	<=	2	1	4	1
58	Vancomycin VAN	<=	1	0.5	2	1
59	Cefoxitin FOX	=	4	1	4	1
59	Chloramphenicol CHL	=	8	2	16	1
59	Ciprofloxacin CIP	<=	0.25	0.12	0.5	1
59	Clindamycin CLN	<=	0.12	0.06	0.25	1
59	Erythromycin ERY	=	0.5	0.25	1	1
59	Gentamicin GEN	<=	1	0.12	1	1
59	Linezolid LZD	=	2	1	4	1
59	Quinupristin/dalfopristin (Synercid) SYN	<=	0.5	0.25	1	1
59	Sulfamethoxazole SMX	<=	64	32	128	1
59	Tetracycline TET	<=	0.5	0.12	1	1
59	Trimethoprim TMP	<=	2	1	4	1
59	Vancomycin VAN	<=	1	0.5	2	1

Appendix 6c

***Escherichia coli* ATCC 25922 results**

Lab code	Antimicrobial	Abbreviation	Operator	Read_Value	Min. Value	Max. Value	Score
2	Ampicillin	AMP	=	4	2.0	8.0	1
2	Cefepime	FEP	<=	0.06	0.016	0.12	1
2	Cefotaxime	FOT	<=	0.25	0.03	0.12	1
2	Cefotaxime	FOT	<=	0.25	0.03	0.12	1
2	Cefoxitin	FOX	=	2	2.0	8.0	1
2	Ceftazidime	TAZ	<=	0.5	0.06	0.5	1
2	Ceftazidime	TAZ	=	0.5	0.06	0.5	1
2	Chloramphenicol	CHL	<=	8	2.0	8.0	1
2	Ciprofloxacin	CIP	<=	0.015	0.004	0.016	1
2	Colistin	COL	<=	1	0.25	2.0	1
2	Ertapenem	ETP	<=	0.015	0.004	0.016	1
2	Gentamicin	GEN	<=	0.5	0.25	1.0	1
2	Imipenem	IMI	<=	0.12	0.06	0.25	1
2	Meropenem	MERO	<=	0.03	0.008	0.06	1
2	Meropenem	MERO	<=	0.03	0.008	0.06	1
2	Nalidixic acid	NAL	<=	4	1.0	4.0	1
2	Sulfamethoxazole	SMX	=	32	8.0	32.0	1
2	Tetracycline	TET	<=	2	0.5	2.0	1
2	Tigecycline	TGC	<=	0.25	0.03	0.25	1
2	Trimethoprim	TMP	=	1	0.5	2.0	1
4	Ampicillin	AMP		4	2.0	8.0	1
4	Cefepime	FEP	<=	0.06	0.016	0.12	1
4	Cefotaxime	FOT	<=	0.25	0.03	0.12	1
4	Cefotaxime	FOT	<=	0.25	0.03	0.12	1
4	Cefoxitin	FOX	=	4	2.0	8.0	1
4	Ceftazidime	TAZ	<=	0.5	0.06	0.5	1
4	Ceftazidime	TAZ	<=	0.25	0.06	0.5	1
4	Chloramphenicol	CHL	<=	8	2.0	8.0	1
4	Ciprofloxacin	CIP	<=	0.015	0.004	0.016	1
4	Colistin	COL	<=	1	0.25	2.0	1
4	Ertapenem	ETP	<=	0.015	0.004	0.016	1
4	Gentamicin	GEN	<=	0.5	0.25	1.0	1
4	Imipenem	IMI	=	0.25	0.06	0.25	1
4	Meropenem	MERO	<=	0.03	0.008	0.06	1
4	Meropenem	MERO	<=	0.03	0.008	0.06	1
4	Nalidixic acid	NAL	<=	4	1.0	4.0	1
4	Sulfamethoxazole	SMX		64	8.0	32.0	0
4	Tetracycline	TET	<=	2	0.5	2.0	1
4	Tigecycline	TGC	<=	0.25	0.03	0.25	1
4	Trimethoprim	TMP	=	0.5	0.5	2.0	1
6	Ampicillin	AMP	=	8	2.0	8.0	1
6	Cefepime	FEP	<=	0.06	0.016	0.12	1
6	Cefotaxime	FOT	<=	0.25	0.03	0.12	1
6	Cefotaxime	FOT	<=	0.25	0.03	0.12	1
6	Cefoxitin	FOX	=	4	2.0	8.0	1
6	Ceftazidime	TAZ	<=	0.5	0.06	0.5	1
6	Ceftazidime	TAZ	<=	0.25	0.06	0.5	1
6	Chloramphenicol	CHL	<=	8	2.0	8.0	1
6	Ciprofloxacin	CIP	<=	0.015	0.004	0.016	1
6	Colistin	COL	<=	1	0.25	2.0	1
6	Ertapenem	ETP	<=	0.015	0.004	0.016	1
6	Gentamicin	GEN	<=	0.5	0.25	1.0	1
6	Imipenem	IMI	<=	0.12	0.06	0.25	1
6	Meropenem	MERO	<=	0.03	0.008	0.06	1
6	Meropenem	MERO	<=	0.03	0.008	0.06	1
6	Nalidixic acid	NAL	<=	4	1.0	4.0	1
6	Sulfamethoxazole	SMX	=	32	8.0	32.0	1
6	Tetracycline	TET	<=	2	0.5	2.0	1
6	Tigecycline	TGC	<=	0.25	0.03	0.25	1
6	Trimethoprim	TMP	=	1	0.5	2.0	1

9	Ampicillin	AMP	=	4	2.0	8.0	1
9	Cefepime	FEP	=	0.06	0.016	0.12	1
9	Cefotaxime	FOT	<=	0.25	0.03	0.12	1
9	Cefoxitin	FOX	=	4	2.0	8.0	1
9	Ceftazidime	TAZ	<=	0.5	0.06	0.5	1
9	Ceftazidime	TAZ	<=	0.25	0.06	0.5	1
9	Chloramphenicol	CHL	<=	8	2.0	8.0	1
9	Ciprofloxacin	CIP	<=	0.015	0.004	0.016	1
9	Colistin	COL	<=	1	0.25	2.0	1
9	Ertapenem	ETP	<=	0.015	0.004	0.016	1
9	Gentamicin	GEN	<=	0.5	0.25	1.0	1
9	Imipenem	IMI	<=	0.12	0.06	0.25	1
9	Meropenem	MERO	<=	0.03	0.008	0.06	1
9	Meropenem	MERO	<=	0.03	0.008	0.06	1
9	Nalidixic acid	NAL	<=	4	1.0	4.0	1
9	Sulfamethoxazole	SMX	=	16	8.0	32.0	1
9	Tetracycline	TET	<=	2	0.5	2.0	1
9	Tigecycline	TGC	<=	0.25	0.03	0.25	1
9	Trimethoprim	TMP	=	1	0.5	2.0	1
11	Ampicillin	AMP	=	4	2.0	8.0	1
11	Cefepime	FEP	<=	0.06	0.016	0.12	1
11	Cefotaxime	FOT	<=	0.25	0.03	0.12	1
11	Cefotaxime	FOT	<=	0.25	0.03	0.12	1
11	Cefoxitin	FOX	=	4	2.0	8.0	1
11	Ceftazidime	TAZ	<=	0.5	0.06	0.5	1
11	Ceftazidime	TAZ	<=	0.25	0.06	0.5	1
11	Chloramphenicol	CHL	<=	8	2.0	8.0	1
11	Ciprofloxacin	CIP	<=	0.015	0.004	0.016	1
11	Colistin	COL	<=	1	0.25	2.0	1
11	Ertapenem	ETP	<=	0.015	0.004	0.016	1
11	Gentamicin	GEN	=	1	0.25	1.0	1
11	Imipenem	IMI	<=	0.12	0.06	0.25	1
11	Meropenem	MERO	<=	0.03	0.008	0.06	1
11	Meropenem	MERO	<=	0.03	0.008	0.06	1
11	Nalidixic acid	NAL	<=	4	1.0	4.0	1
11	Sulfamethoxazole	SMX	=	16	8.0	32.0	1
11	Tetracycline	TET	<=	2	0.5	2.0	1
11	Tigecycline	TGC	<=	0.25	0.03	0.25	1
11	Trimethoprim	TMP	=	0.5	0.5	2.0	1
12	Ampicillin	AMP	=	4	2.0	8.0	1
12	Cefepime	FEP	<=	0.06	0.016	0.12	1
12	Cefotaxime	FOT	<=	0.25	0.03	0.12	1
12	Cefotaxime	FOT	<=	0.25	0.03	0.12	1
12	Cefoxitin	FOX	=	4	2.0	8.0	1
12	Ceftazidime	TAZ	<=	0.5	0.06	0.5	1
12	Ceftazidime	TAZ	<=	0.25	0.06	0.5	1
12	Chloramphenicol	CHL	<=	8	2.0	8.0	1
12	Ciprofloxacin	CIP	<=	0.015	0.004	0.016	1
12	Colistin	COL	<=	1	0.25	2.0	1
12	Ertapenem	ETP	<=	0.015	0.004	0.016	1
12	Gentamicin	GEN	<=	0.5	0.25	1.0	1
12	Imipenem	IMI	=	0.25	0.06	0.25	1
12	Meropenem	MERO	<=	0.03	0.008	0.06	1
12	Meropenem	MERO	<=	0.03	0.008	0.06	1
12	Nalidixic acid	NAL	<=	4	1.0	4.0	1
12	Sulfamethoxazole	SMX	=	32	8.0	32.0	1
12	Tetracycline	TET	<=	2	0.5	2.0	1
12	Tigecycline	TGC	<=	0.25	0.03	0.25	1
12	Trimethoprim	TMP	=	1	0.5	2.0	1
16	Ampicillin	AMP	=	8	2.0	8.0	1
16	Cefepime	FEP	<=	0.06	0.016	0.12	1
16	Cefotaxime	FOT	<=	0.25	0.03	0.12	1
16	Cefotaxime	FOT	<=	0.25	0.03	0.12	1

16	Cefoxitin	FOX	=	2	2.0	8.0	1
16	Ceftazidime	TAZ	<=	0.5	0.06	0.5	1
16	Ceftazidime	TAZ	=	0.5	0.06	0.5	1
16	Chloramphenicol	CHL	<=	8	2.0	8.0	1
16	Ciprofloxacin	CIP	<=	0.015	0.004	0.016	1
16	Colistin	COL	<=	1	0.25	2.0	1
16	Ertapenem	ETP	<=	0.015	0.004	0.016	1
16	Gentamicin	GEN	<=	0.5	0.25	1.0	1
16	Imipenem	IMI	<=	0.12	0.06	0.25	1
16	Meropenem	MERO	<=	0.03	0.008	0.06	1
16	Meropenem	MERO	<=	0.03	0.008	0.06	1
16	Nalidixic acid	NAL	<=	4	1.0	4.0	1
16	Sulfamethoxazole	SMX	=	32	8.0	32.0	1
16	Tetracycline	TET	<=	2	0.5	2.0	1
16	Tigecycline	TGC	<=	0.25	0.03	0.25	1
16	Trimethoprim	TMP	=	1	0.5	2.0	1
17	Ampicillin	AMP	=	4	2.0	8.0	1
17	Cefepime	FEP	<=	0.06	0.016	0.12	1
17	Cefotaxime	FOT	<=	0.25	0.03	0.12	1
17	Cefotaxime	FOT	<=	0.25	0.03	0.12	1
17	Cefoxitin	FOX	=	4	2.0	8.0	1
17	Ceftazidime	TAZ	<=	0.5	0.06	0.5	1
17	Ceftazidime	TAZ	<=	0.25	0.06	0.5	1
17	Chloramphenicol	CHL	<=	8	2.0	8.0	1
17	Ciprofloxacin	CIP	<=	0.015	0.004	0.016	1
17	Colistin	COL	<=	1	0.25	2.0	1
17	Ertapenem	ETP	<=	0.015	0.004	0.016	1
17	Gentamicin	GEN	<=	0.5	0.25	1.0	1
17	Imipenem	IMI	=	0.25	0.06	0.25	1
17	Meropenem	MERO	<=	0.03	0.008	0.06	1
17	Meropenem	MERO	<=	0.03	0.008	0.06	1
17	Nalidixic acid	NAL	<=	4	1.0	4.0	1
17	Sulfamethoxazole	SMX	<=	8	8.0	32.0	1
17	Tetracycline	TET	<=	2	0.5	2.0	1
17	Tigecycline	TGC	<=	0.25	0.03	0.25	1
17	Trimethoprim	TMP	=	0.5	0.5	2.0	1
18	Ampicillin	AMP	=	4	2.0	8.0	1
18	Cefepime	FEP	<=	0.06	0.016	0.12	1
18	Cefotaxime	FOT	<=	0.25	0.03	0.12	1
18	Cefotaxime	FOT	<=	0.25	0.03	0.12	1
18	Cefoxitin	FOX	=	2	2.0	8.0	1
18	Ceftazidime	TAZ	<=	0.5	0.06	0.5	1
18	Ceftazidime	TAZ	<=	0.5	0.06	0.5	1
18	Chloramphenicol	CHL	=	4	2.0	8.0	1
18	Ciprofloxacin	CIP	<=	0.015	0.004	0.016	1
18	Colistin	COL	<=	1	0.25	2.0	1
18	Ertapenem	ETP	<=	0.015	0.004	0.016	1
18	Gentamicin	GEN	<=	0.5	0.25	1.0	1
18	Imipenem	IMI	<=	0.12	0.06	0.25	1
18	Meropenem	MERO	<=	0.03	0.008	0.06	1
18	Meropenem	MERO	<=	0.03	0.008	0.06	1
18	Nalidixic acid	NAL	<=	4	1.0	4.0	1
18	Sulfamethoxazole	SMX	=	16	8.0	32.0	1
18	Tetracycline	TET	<=	2	0.5	2.0	1
18	Tigecycline	TGC	<=	0.25	0.03	0.25	1
18	Trimethoprim	TMP	<=	0.5	0.5	2.0	1
19	Ampicillin	AMP	=	2	2.0	8.0	1
19	Cefepime	FEP	<=	0.06	0.016	0.12	1
19	Cefotaxime	FOT	<=	0.25	0.03	0.12	1
19	Cefotaxime	FOT	<=	0.25	0.03	0.12	1
19	Cefoxitin	FOX	=	2	2.0	8.0	1
19	Ceftazidime	TAZ	<=	0.5	0.06	0.5	1
19	Ceftazidime	TAZ	<=	0.25	0.06	0.5	1

19	Chloramphenicol	CHL	<=	8	2.0	8.0	1
19	Ciprofloxacin	CIP	<=	0.015	0.004	0.016	1
19	Colistin	COL	<=	1	0.25	2.0	1
19	Ertapenem	ETP	<=	0.015	0.004	0.016	1
19	Gentamicin	GEN	<=	0.5	0.25	1.0	1
19	Imipenem	IMI	<=	0.12	0.06	0.25	1
19	Meropenem	MERO	<=	0.03	0.008	0.06	1
19	Meropenem	MERO	<=	0.03	0.008	0.06	1
19	Nalidixic acid	NAL	<=	4	1.0	4.0	1
19	Sulfamethoxazole	SMX	=	32	8.0	32.0	1
19	Tetracycline	TET	<=	2	0.5	2.0	1
19	Tigecycline	TGC	<=	0.25	0.03	0.25	1
19	Trimethoprim	TMP	=	0.5	0.5	2.0	1
20	Ampicillin	AMP	=	4	2.0	8.0	1
20	Cefepime	FEP	<=	0.06	0.016	0.12	1
20	Cefotaxime	FOT	<=	0.25	0.03	0.12	1
20	Cefotaxime	FOT	<=	0.25	0.03	0.12	1
20	Cefoxitin	FOX	=	2	2.0	8.0	1
20	Ceftazidime	TAZ	<=	0.5	0.06	0.5	1
20	Ceftazidime	TAZ	<=	0.25	0.06	0.5	1
20	Chloramphenicol	CHL	<=	8	2.0	8.0	1
20	Ciprofloxacin	CIP	<=	0.015	0.004	0.016	1
20	Colistin	COL	<=	1	0.25	2.0	1
20	Ertapenem	ETP	<=	0.015	0.004	0.016	1
20	Gentamicin	GEN	<=	0.5	0.25	1.0	1
20	Imipenem	IMI	<=	0.12	0.06	0.25	1
20	Meropenem	MERO	<=	0.03	0.008	0.06	1
20	Meropenem	MERO	<=	0.03	0.008	0.06	1
20	Nalidixic acid	NAL	<=	4	1.0	4.0	1
20	Sulfamethoxazole	SMX	=	16	8.0	32.0	1
20	Tetracycline	TET	<=	2	0.5	2.0	1
20	Tigecycline	TGC	<=	0.25	0.03	0.25	1
20	Trimethoprim	TMP	=	0.5	0.5	2.0	1
21	Ampicillin	AMP	=	4	2.0	8.0	1
21	Cefepime	FEP	<=	0.06	0.016	0.12	1
21	Cefotaxime	FOT	<=	0.25	0.03	0.12	1
21	Cefotaxime	FOT	<=	0.25	0.03	0.12	1
21	Cefoxitin	FOX	=	2	2.0	8.0	1
21	Ceftazidime	TAZ	<=	0.5	0.06	0.5	1
21	Ceftazidime	TAZ	<=	0.25	0.06	0.5	1
21	Chloramphenicol	CHL	<=	8	2.0	8.0	1
21	Ciprofloxacin	CIP	<=	0.015	0.004	0.016	1
21	Colistin	COL	<=	1	0.25	2.0	1
21	Ertapenem	ETP	<=	0.015	0.004	0.016	1
21	Gentamicin	GEN	<=	0.5	0.25	1.0	1
21	Imipenem	IMI	<=	0.12	0.06	0.25	1
21	Meropenem	MERO	<=	0.03	0.008	0.06	1
21	Meropenem	MERO	<=	0.03	0.008	0.06	1
21	Nalidixic acid	NAL	<=	4	1.0	4.0	1
21	Sulfamethoxazole	SMX	=	16	8.0	32.0	1
21	Tetracycline	TET	<=	2	0.5	2.0	1
21	Tigecycline	TGC	<=	0.25	0.03	0.25	1
21	Trimethoprim	TMP	=	0.5	0.5	2.0	1
22	Ampicillin	AMP	=	4	2.0	8.0	1
22	Cefepime	FEP	<=	0.06	0.016	0.12	1
22	Cefotaxime	FOT	<=	0.25	0.03	0.12	1
22	Cefotaxime	FOT	<=	0.25	0.03	0.12	1
22	Cefoxitin	FOX	=	2	2.0	8.0	1
22	Ceftazidime	TAZ	<=	0.5	0.06	0.5	1
22	Ceftazidime	TAZ	<=	0.25	0.06	0.5	1
22	Chloramphenicol	CHL	<=	8	2.0	8.0	1
22	Ciprofloxacin	CIP	<=	0.015	0.004	0.016	1
22	Colistin	COL	<=	1	0.25	2.0	1

22	Ertapenem	ETP	<=	0.015	0.004	0.016	1
22	Gentamicin	GEN	<=	0.5	0.25	1.0	1
22	Imipenem	IMI	<=	0.12	0.06	0.25	1
22	Meropenem	MERO	<=	0.03	0.008	0.06	1
22	Meropenem	MERO	<=	0.03	0.008	0.06	1
22	Nalidixic acid	NAL	<=	4	1.0	4.0	1
22	Sulfamethoxazole	SMX	=	32	8.0	32.0	1
22	Tetracycline	TET	<=	2	0.5	2.0	1
22	Tigecycline	TGC	<=	0.25	0.03	0.25	1
22	Trimethoprim	TMP	=	0.5	0.5	2.0	1
23	Ampicillin	AMP	=	4	2.0	8.0	1
23	Cefepime	FEP	<=	0.06	0.016	0.12	1
23	Cefotaxime	FOT	<=	0.25	0.03	0.12	1
23	Cefotaxime	FOT	<=	0.25	0.03	0.12	1
23	Cefoxitin	FOX	=	2	2.0	8.0	1
23	Ceftazidime	TAZ	<=	0.5	0.06	0.5	1
23	Ceftazidime	TAZ	<=	0.25	0.06	0.5	1
23	Chloramphenicol	CHL	<=	8	2.0	8.0	1
23	Ciprofloxacin	CIP	<=	0.015	0.004	0.016	1
23	Colistin	COL	<=	1	0.25	2.0	1
23	Ertapenem	ETP	<=	0.015	0.004	0.016	1
23	Gentamicin	GEN	<=	0.5	0.25	1.0	1
23	Imipenem	IMI	=	0.25	0.06	0.25	1
23	Meropenem	MERO	<=	0.03	0.008	0.06	1
23	Meropenem	MERO	<=	0.03	0.008	0.06	1
23	Nalidixic acid	NAL	<=	4	1.0	4.0	1
23	Sulfamethoxazole	SMX	=	16	8.0	32.0	1
23	Tetracycline	TET	<=	2	0.5	2.0	1
23	Tigecycline	TGC	<=	0.25	0.03	0.25	1
23	Trimethoprim	TMP	=	0.5	0.5	2.0	1
25	Ampicillin	AMP	=	4	2.0	8.0	1
25	Cefotaxime	FOT	<=	0.25	0.03	0.12	1
25	Ceftazidime	TAZ	<=	0.5	0.06	0.5	1
25	Chloramphenicol	CHL	<=	8	2.0	8.0	1
25	Ciprofloxacin	CIP	<=	0.015	0.004	0.016	1
25	Colistin	COL	<=	1	0.25	2.0	1
25	Gentamicin	GEN	<=	0.5	0.25	1.0	1
25	Meropenem	MERO	<=	0.03	0.008	0.06	1
25	Nalidixic acid	NAL	<=	4	1.0	4.0	1
25	Sulfamethoxazole	SMX	<=	8	8.0	32.0	1
25	Tetracycline	TET	<=	2	0.5	2.0	1
25	Tigecycline	TGC	<=	0.25	0.03	0.25	1
25	Trimethoprim	TMP	=	0.5	0.5	2.0	1
26	Ampicillin	AMP	=	2	2.0	8.0	1
26	Cefotaxime	FOT	<=	0.25	0.03	0.12	1
26	Ceftazidime	TAZ	<=	0.5	0.06	0.5	1
26	Chloramphenicol	CHL	<=	8	2.0	8.0	1
26	Ciprofloxacin	CIP	<=	0.015	0.004	0.016	1
26	Colistin	COL	<=	1	0.25	2.0	1
26	Gentamicin	GEN	<=	0.5	0.25	1.0	1
26	Meropenem	MERO	<=	0.03	0.008	0.06	1
26	Nalidixic acid	NAL	<=	4	1.0	4.0	1
26	Sulfamethoxazole	SMX	=	64	8.0	32.0	0
26	Tetracycline	TET	<=	2	0.5	2.0	1
26	Tigecycline	TGC	<=	0.25	0.03	0.25	1
26	Trimethoprim	TMP	=	0.5	0.5	2.0	1
29	Ampicillin	AMP		4	2.0	8.0	1
29	Cefepime	FEP	<=	0.06	0.016	0.12	1
29	Cefotaxime	FOT	<=	0.25	0.03	0.12	1
29	Cefotaxime	FOT	<=	0.25	0.03	0.12	1
29	Cefoxitin	FOX		2	2.0	8.0	1
29	Ceftazidime	TAZ	<=	0.5	0.06	0.5	1
29	Ceftazidime	TAZ	<=	0.25	0.06	0.5	1

29	Chloramphenicol	CHL	<=	8	2.0	8.0	1
29	Ciprofloxacin	CIP	<=	0.015	0.004	0.016	1
29	Colistin	COL	<=	1	0.25	2.0	1
29	Ertapenem	ETP	<=	0.015	0.004	0.016	1
29	Gentamicin	GEN	<=	0.5	0.25	1.0	1
29	Imipenem	IMI	<=	0.12	0.06	0.25	1
29	Meropenem	MERO	<=	0.03	0.008	0.06	1
29	Meropenem	MERO	<=	0.03	0.008	0.06	1
29	Nalidixic acid	NAL	<=	4	1.0	4.0	1
29	Sulfamethoxazole	SMX		16	8.0	32.0	1
29	Tetracycline	TET	<=	2	0.5	2.0	1
29	Tigecycline	TGC	<=	0.25	0.03	0.25	1
29	Trimethoprim	TMP	<=	0.25	0.5	2.0	0
30	Ampicillin	AMP	=	8	2.0	8.0	1
30	Cefepime	FEP	<=	0.06	0.016	0.12	1
30	Cefotaxime	FOT	<=	0.25	0.03	0.12	1
30	Cefotaxime	FOT	<=	0.25	0.03	0.12	1
30	Cefoxitin	FOX	=	4	2.0	8.0	1
30	Ceftazidime	TAZ	<=	0.5	0.06	0.5	1
30	Ceftazidime	TAZ	<=	0.25	0.06	0.5	1
30	Chloramphenicol	CHL	<=	8	2.0	8.0	1
30	Ciprofloxacin	CIP	<=	0.015	0.004	0.016	1
30	Colistin	COL	<=	1	0.25	2.0	1
30	Ertapenem	ETP	<=	0.015	0.004	0.016	1
30	Gentamicin	GEN	=	1	0.25	1.0	1
30	Imipenem	IMI	=	0.25	0.06	0.25	1
30	Meropenem	MERO	<=	0.03	0.008	0.06	1
30	Meropenem	MERO	<=	0.03	0.008	0.06	1
30	Nalidixic acid	NAL	<=	4	1.0	4.0	1
30	Sulfamethoxazole	SMX	=	16	8.0	32.0	1
30	Tetracycline	TET	<=	2	0.5	2.0	1
30	Tigecycline	TGC	<=	0.25	0.03	0.25	1
30	Trimethoprim	TMP	=	0.5	0.5	2.0	1
32	Ampicillin	AMP	=	8	2.0	8.0	1
32	Cefepime	FEP	<=	0.06	0.016	0.12	1
32	Cefotaxime	FOT	<=	0.25	0.03	0.12	1
32	Cefotaxime	FOT	<=	0.25	0.03	0.12	1
32	Cefoxitin	FOX	=	4	2.0	8.0	1
32	Ceftazidime	TAZ	<=	0.5	0.06	0.5	1
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32	Chloramphenicol	CHL	<=	8	2.0	8.0	1
32	Ciprofloxacin	CIP	<=	0.015	0.004	0.016	1
32	Colistin	COL	<=	1	0.25	2.0	1
32	Ertapenem	ETP	<=	0.015	0.004	0.016	1
32	Gentamicin	GEN	=	1	0.25	1.0	1
32	Imipenem	IMI	<=	0.12	0.06	0.25	1
32	Meropenem	MERO	<=	0.03	0.008	0.06	1
32	Meropenem	MERO	<=	0.03	0.008	0.06	1
32	Nalidixic acid	NAL	<=	4	1.0	4.0	1
32	Sulfamethoxazole	SMX	=	16	8.0	32.0	1
32	Tetracycline	TET	<=	2	0.5	2.0	1
32	Tigecycline	TGC	<=	0.25	0.03	0.25	1
32	Trimethoprim	TMP	=	0.5	0.5	2.0	1
33	Ampicillin	AMP	=	4	2.0	8.0	1
33	Cefepime	FEP	<=	0.06	0.016	0.12	1
33	Cefotaxime	FOT	<=	0.25	0.03	0.12	1
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33	Cefoxitin	FOX	=	2	2.0	8.0	1
33	Ceftazidime	TAZ	<=	0.5	0.06	0.5	1
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33	Chloramphenicol	CHL	<=	8	2.0	8.0	1
33	Ciprofloxacin	CIP	<=	0.015	0.004	0.016	1
33	Colistin	COL	=	2	0.25	2.0	1

33	Ertapenem	ETP	<=	0.015	0.004	0.016	1
33	Gentamicin	GEN	<=	0.5	0.25	1.0	1
33	Imipenem	IMI	<=	0.12	0.06	0.25	1
33	Meropenem	MERO	<=	0.03	0.008	0.06	1
33	Meropenem	MERO	<=	0.03	0.008	0.06	1
33	Nalidixic acid	NAL	<=	4	1.0	4.0	1
33	Sulfamethoxazole	SMX	=	32	8.0	32.0	1
33	Tetracycline	TET	<=	2	0.5	2.0	1
33	Tigecycline	TGC	<=	0.25	0.03	0.25	1
33	Trimethoprim	TMP	=	1	0.5	2.0	1
34	Ampicillin	AMP	=	4	2.0	8.0	1
34	Cefepime	FEP	<=	0.06	0.016	0.12	1
34	Cefotaxime	FOT	<=	0.25	0.03	0.12	1
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34	Cefoxitin	FOX	=	4	2.0	8.0	1
34	Ceftazidime	TAZ	<=	0.5	0.06	0.5	1
34	Ceftazidime	TAZ	<=	0.25	0.06	0.5	1
34	Chloramphenicol	CHL	<=	8	2.0	8.0	1
34	Ciprofloxacin	CIP	<=	0.015	0.004	0.016	1
34	Colistin	COL	<=	1	0.25	2.0	1
34	Ertapenem	ETP	<=	0.015	0.004	0.016	1
34	Gentamicin	GEN	<=	0.5	0.25	1.0	1
34	Imipenem	IMI	<=	0.12	0.06	0.25	1
34	Meropenem	MERO	<=	0.03	0.008	0.06	1
34	Meropenem	MERO	<=	0.03	0.008	0.06	1
34	Nalidixic acid	NAL	<=	4	1.0	4.0	1
34	Sulfamethoxazole	SMX	=	16	8.0	32.0	1
34	Tetracycline	TET	<=	2	0.5	2.0	1
34	Tigecycline	TGC	<=	0.25	0.03	0.25	1
34	Trimethoprim	TMP	=	1	0.5	2.0	1
36	Ampicillin	AMP	=	8	2.0	8.0	1
36	Cefepime	FEP	<=	0.06	0.016	0.12	1
36	Cefotaxime	FOT	<=	0.25	0.03	0.12	1
36	Cefotaxime	FOT	<=	0.25	0.03	0.12	1
36	Cefoxitin	FOX	=	4	2.0	8.0	1
36	Ceftazidime	TAZ	<=	0.5	0.06	0.5	1
36	Ceftazidime	TAZ	=	0.5	0.06	0.5	1
36	Chloramphenicol	CHL	<=	8	2.0	8.0	1
36	Ciprofloxacin	CIP	<=	0.015	0.004	0.016	1
36	Colistin	COL	<=	1	0.25	2.0	1
36	Ertapenem	ETP	<=	0.015	0.004	0.016	1
36	Gentamicin	GEN	=	1	0.25	1.0	1
36	Imipenem	IMI	=	0.25	0.06	0.25	1
36	Meropenem	MERO	<=	0.03	0.008	0.06	1
36	Meropenem	MERO	<=	0.03	0.008	0.06	1
36	Nalidixic acid	NAL	<=	4	1.0	4.0	1
36	Sulfamethoxazole	SMX	<=	8	8.0	32.0	1
36	Tetracycline	TET	<=	2	0.5	2.0	1
36	Tigecycline	TGC	<=	0.25	0.03	0.25	1
36	Trimethoprim	TMP	=	0.5	0.5	2.0	1
37	Ampicillin	AMP	=	4	2.0	8.0	1
37	Cefotaxime	FOT	<=	0.25	0.03	0.12	1
37	Ceftazidime	TAZ	<=	0.5	0.06	0.5	1
37	Chloramphenicol	CHL	<=	8	2.0	8.0	1
37	Ciprofloxacin	CIP	<=	0.015	0.004	0.016	1
37	Colistin	COL	<=	1	0.25	2.0	1
37	Gentamicin	GEN	<=	0.5	0.25	1.0	1
37	Meropenem	MERO	<=	0.03	0.008	0.06	1
37	Nalidixic acid	NAL	<=	4	1.0	4.0	1
37	Sulfamethoxazole	SMX	=	16	8.0	32.0	1
37	Tetracycline	TET	<=	2	0.5	2.0	1
37	Tigecycline	TGC	<=	0.25	0.03	0.25	1
37	Trimethoprim	TMP	=	0.5	0.5	2.0	1

39	Ampicillin	AMP	=	4	2.0	8.0	1
39	Cefepime	FEP	<=	0.06	0.016	0.12	1
39	Cefotaxime	FOT	<=	0.25	0.03	0.12	1
39	Cefotaxime	FOT	<=	0.25	0.03	0.12	1
39	Cefoxitin	FOX	=	4	2.0	8.0	1
39	Ceftazidime	TAZ	<=	0.5	0.06	0.5	1
39	Ceftazidime	TAZ	<=	0.25	0.06	0.5	1
39	Chloramphenicol	CHL	<=	8	2.0	8.0	1
39	Ciprofloxacin	CIP	<=	0.015	0.004	0.016	1
39	Colistin	COL	<=	1	0.25	2.0	1
39	Ertapenem	ETP	<=	0.015	0.004	0.016	1
39	Gentamicin	GEN	<=	0.5	0.25	1.0	1
39	Imipenem	IMI	<=	0.12	0.06	0.25	1
39	Meropenem	MERO	<=	0.03	0.008	0.06	1
39	Meropenem	MERO	<=	0.03	0.008	0.06	1
39	Nalidixic acid	NAL	<=	4	1.0	4.0	1
39	Sulfamethoxazole	SMX	=	32	8.0	32.0	1
39	Tetracycline	TET	<=	2	0.5	2.0	1
39	Tigecycline	TGC	<=	0.25	0.03	0.25	1
39	Trimethoprim	TMP	=	0.5	0.5	2.0	1
40	Ampicillin	AMP	=	2	2.0	8.0	1
40	Cefepime	FEP	=	0.06	0.016	0.12	1
40	Cefotaxime	FOT	=	0.12	0.03	0.12	1
40	Cefotaxime	FOT	=	0.12	0.03	0.12	1
40	Cefoxitin	FOX	=	2	2.0	8.0	1
40	Ceftazidime	TAZ	=	0.5	0.06	0.5	1
40	Ceftazidime	TAZ	=	0.5	0.06	0.5	1
40	Chloramphenicol	CHL	=	8	2.0	8.0	1
40	Ciprofloxacin	CIP	=	0.015	0.004	0.016	1
40	Colistin	COL	=	1	0.25	2.0	1
40	Ertapenem	ETP	=	0.015	0.004	0.016	1
40	Gentamicin	GEN	=	0.5	0.25	1.0	1
40	Imipenem	IMI	=	0.25	0.06	0.25	1
40	Meropenem	MERO	=	0.06	0.008	0.06	1
40	Meropenem	MERO	=	0.06	0.008	0.06	1
40	Nalidixic acid	NAL	=	4	1.0	4.0	1
40	Sulfamethoxazole	SMX	=	16	8.0	32.0	1
40	Tetracycline	TET	=	2	0.5	2.0	1
40	Tigecycline	TGC	=	0.25	0.03	0.25	1
40	Trimethoprim	TMP	=	0.5	0.5	2.0	1
42	Ampicillin	AMP	=	8	2.0	8.0	1
42	Cefepime	FEP	<=	0.06	0.016	0.12	1
42	Cefotaxime	FOT	<=	0.25	0.03	0.12	1
42	Cefotaxime	FOT	<=	0.25	0.03	0.12	1
42	Cefoxitin	FOX	=	4	2.0	8.0	1
42	Ceftazidime	TAZ	<=	0.5	0.06	0.5	1
42	Ceftazidime	TAZ	=	0.5	0.06	0.5	1
42	Chloramphenicol	CHL	<=	8	2.0	8.0	1
42	Ciprofloxacin	CIP	<=	0.015	0.004	0.016	1
42	Colistin	COL	<=	1	0.25	2.0	1
42	Ertapenem	ETP	<=	0.015	0.004	0.016	1
42	Gentamicin	GEN	<=	0.5	0.25	1.0	1
42	Imipenem	IMI	<=	0.12	0.06	0.25	1
42	Meropenem	MERO	<=	0.03	0.008	0.06	1
42	Meropenem	MERO	<=	0.03	0.008	0.06	1
42	Nalidixic acid	NAL	<=	4	1.0	4.0	1
42	Sulfamethoxazole	SMX	=	32	8.0	32.0	1
42	Tetracycline	TET	<=	2	0.5	2.0	1
42	Tigecycline	TGC	<=	0.25	0.03	0.25	1
42	Trimethoprim	TMP	=	1	0.5	2.0	1
45	Ampicillin	AMP	=	4	2.0	8.0	1
45	Cefepime	FEP	<=	0.06	0.016	0.12	1
45	Cefotaxime	FOT	<=	0.25	0.03	0.12	1

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45	Cefoxitin	FOX	=	4	2.0	8.0	1
45	Ceftazidime	TAZ	<=	0.5	0.06	0.5	1
45	Ceftazidime	TAZ	<=	0.25	0.06	0.5	1
45	Chloramphenicol	CHL	<=	8	2.0	8.0	1
45	Ciprofloxacin	CIP	<=	0.015	0.004	0.016	1
45	Colistin	COL	<=	1	0.25	2.0	1
45	Ertapenem	ETP	<=	0.015	0.004	0.016	1
45	Gentamicin	GEN	<=	0.5	0.25	1.0	1
45	Imipenem	IMI	<=	0.12	0.06	0.25	1
45	Meropenem	MERO	<=	0.03	0.008	0.06	1
45	Meropenem	MERO	<=	0.03	0.008	0.06	1
45	Nalidixic acid	NAL	<=	4	1.0	4.0	1
45	Sulfamethoxazole	SMX	=	32	8.0	32.0	1
45	Tetracycline	TET	<=	2	0.5	2.0	1
45	Tigecycline	TGC	<=	0.25	0.03	0.25	1
45	Trimethoprim	TMP	=	0.5	0.5	2.0	1
56	Ampicillin	AMP	=	8	2.0	8.0	1
56	Cefepime	FEP	<=	0.06	0.016	0.12	1
56	Cefotaxime	FOT	<=	0.25	0.03	0.12	1
56	Cefotaxime	FOT	<=	0.25	0.03	0.12	1
56	Cefoxitin	FOX	=	4	2.0	8.0	1
56	Ceftazidime	TAZ	<=	0.5	0.06	0.5	1
56	Ceftazidime	TAZ	<=	0.25	0.06	0.5	1
56	Chloramphenicol	CHL	<=	8	2.0	8.0	1
56	Ciprofloxacin	CIP	<=	0.015	0.004	0.016	1
56	Colistin	COL	<=	1	0.25	2.0	1
56	Ertapenem	ETP	<=	0.015	0.004	0.016	1
56	Gentamicin	GEN	<=	0.5	0.25	1.0	1
56	Imipenem	IMI	<=	0.12	0.06	0.25	1
56	Meropenem	MERO	<=	0.03	0.008	0.06	1
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56	Nalidixic acid	NAL	<=	4	1.0	4.0	1
56	Sulfamethoxazole	SMX	=	16	8.0	32.0	1
56	Tetracycline	TET	<=	2	0.5	2.0	1
56	Tigecycline	TGC	<=	0.25	0.03	0.25	1
56	Trimethoprim	TMP	=	0.5	0.5	2.0	1
58	Ampicillin	AMP	=	8	2.0	8.0	1
58	Cefepime	FEP	<=	0.06	0.016	0.12	1
58	Cefotaxime	FOT	<=	0.25	0.03	0.12	1
58	Cefotaxime	FOT	<=	0.25	0.03	0.12	1
58	Cefoxitin	FOX	=	4	2.0	8.0	1
58	Ceftazidime	TAZ	<=	0.5	0.06	0.5	1
58	Ceftazidime	TAZ	=	0.5	0.06	0.5	1
58	Chloramphenicol	CHL	<=	8	2.0	8.0	1
58	Ciprofloxacin	CIP	<=	0.015	0.004	0.016	1
58	Colistin	COL	<=	1	0.25	2.0	1
58	Ertapenem	ETP	<=	0.015	0.004	0.016	1
58	Gentamicin	GEN	<=	0.5	0.25	1.0	1
58	Imipenem	IMI	<=	0.12	0.06	0.25	1
58	Meropenem	MERO	<=	0.03	0.008	0.06	1
58	Meropenem	MERO	<=	0.03	0.008	0.06	1
58	Nalidixic acid	NAL	<=	4	1.0	4.0	1
58	Sulfamethoxazole	SMX	=	16	8.0	32.0	1
58	Tetracycline	TET	<=	2	0.5	2.0	1
58	Tigecycline	TGC	<=	0.25	0.03	0.25	1
58	Trimethoprim	TMP	=	1	0.5	2.0	1
59	Ampicillin	AMP	=	4	2.0	8.0	1
59	Cefepime	FEP	<=	0.06	0.016	0.12	1
59	Cefotaxime	FOT	<=	0.25	0.03	0.12	1
59	Cefotaxime	FOT	<=	0.25	0.03	0.12	1
59	Cefoxitin	FOX	=	4	2.0	8.0	1
59	Ceftazidime	TAZ	<=	0.5	0.06	0.5	1

59	Ceftazidime	TAZ	<=	0.5	0.06	0.5	1
59	Chloramphenicol	CHL	<=	8	2.0	8.0	1
59	Ciprofloxacin	CIP	<=	0.015	0.004	0.016	1
59	Colistin	COL	<=	1	0.25	2.0	1
59	Ertapenem	ETP	<=	0.015	0.004	0.016	1
59	Gentamicin	GEN	<=	0.5	0.25	1.0	1
59	Imipenem	IMI	<=	0.12	0.06	0.25	1
59	Meropenem	MERO	<=	0.03	0.008	0.06	1
59	Meropenem	MERO	<=	0.03	0.008	0.06	1
59	Nalidixic acid	NAL	<=	4	1.0	4.0	1
59	Sulfamethoxazole	SMX	>	1024	8.0	32.0	0
59	Tetracycline	TET	<=	2	0.5	2.0	1
59	Tigecycline	TGC	<=	0.25	0.03	0.25	1
59	Trimethoprim	TMP	=	0.5	0.5	2.0	1
60	Ampicillin	AMP	=	8	2.0	8.0	1
60	Cefotaxime	FOT	<=	0.25	0.03	0.12	1
60	Ceftazidime	TAZ	<=	0.5	0.06	0.5	1
60	Chloramphenicol	CHL	<=	8	2.0	8.0	1
60	Ciprofloxacin	CIP	<=	0.015	0.004	0.016	1
60	Colistin	COL	<=	1	0.25	2.0	1
60	Gentamicin	GEN	<=	0.5	0.25	1.0	1
60	Meropenem	MERO	<=	0.03	0.008	0.06	1
60	Nalidixic acid	NAL	<=	4	1.0	4.0	1
60	Sulfamethoxazole	SMX	<=	8	8.0	32.0	1
60	Tetracycline	TET	<=	2	0.5	2.0	1
60	Tigecycline	TGC	<=	0.25	0.03	0.25	1
60	Trimethoprim	TMP	<=	0.25	0.5	2.0	0

Appendix 7a

Enterococci - summary of results

Antimicrobial	EURL ENT-11.1		EURL ENT-11.2		EURL ENT-11.3		EURL ENT-11.4		EURL ENT-11.5		EURL ENT-11.6		EURL ENT-11.7		EURL ENT-11.8	
	Correct	Tested	Correct	Tested	Correct	Tested	Correct	Tested	Correct	Tested	Correct	Tested	Correct	Tested	Correct	Tested
Ampicillin AMP	26	26	26	26	26	26	26	26	5	26	26	26	25	26	26	26
Chloramphenicol CHL	27	27	27	27	27	27	27	27	26	27	26	27	26	27	17	27
Ciprofloxacin CIP	26	26	26	26	26	26	26	26	26	26	26	26	25	26	26	26
Daptomycin DAP	24	24	24	24	24	24	23	24	24	24	24	24	24	24	24	24
Erythromycin ERY	27	27	27	27	27	27	27	27	27	27	27	27	25	27	25	27
Gentamicin GEN	27	27	27	27	27	27	27	27	26	27	27	27	26	27	26	27
Linezolid LZD	27	27	27	27	26	27	27	27	27	27	27	27	26	26	26	27
Quinupristin/dalfopristin (Synercid) SYN	25	25	8	8	8	8	25	25	23	25	23	25	25	25	8	9
Teicoplanin TEI	24	24	24	24	24	24	24	24	24	24	24	24	24	24	23	24
Tetracycline TET	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27
Tigecycline TGC	25	25	23	25	25	25	25	25	25	25	25	25	25	25	24	25
Vancomycin VAN	27	27	27	27	27	27	27	27	27	27	27	27	27	27	25	27

Excluded from report (>25% deviations)

Antimicrobial	EURL ENT-11.1		EURL ENT-11.2		EURL ENT-11.3		EURL ENT-11.4		EURL ENT-11.5		EURL ENT-11.6		EURL ENT-11.7		EURL ENT-11.8	
	Deviation (no.)	Deviation (%)	Deviation (no.)	Deviation (%)	Deviation (no.)	Deviation %)	Deviation (no.)	Deviation (%)	Deviation (no.)	Deviation (%)	Deviation (no.)	Deviation (%)	Deviation (no.)	Deviation (%)	Deviation (no.)	Deviation (%)
Ampicillin AMP	0	0	0	0	0	0	0	0	21	80,8	0	0	1	3,8	0	0
Chloramphenicol CHL	0	0	0	0	0	0	0	0	1	3,7	1	3,7	1	3,7	10	37,0
Ciprofloxacin CIP	0	0	0	0	0	0	0	0	0	0	0	0	1	3,8	0	0
Daptomycin DAP	0	0	0	0	0	0	1	4,2	0	0	0	0	0	0	0	0
Erythromycin ERY	0	0	0	0	0	0	0	0	0	0	0	0	2	7,4	2	7,4
Gentamicin GEN	0	0	0	0	0	0	0	0	1	3,7	0	0	1	3,7	1	3,7
Linezolid LZD	0	0	0	0	1	3,7	0	0	0	0	0	0	0	0	1	3,7
Quinupristin/dalfopristin (Synercid) SYN	0	0	0	0	0	0	0	0	2	8	2	8	0	0	1	11,1
Teicoplanin TEI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4,2
Tetracycline TET	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tigecycline TGC	0	0	2	8	0	0	0	0	0	0	0	0	0	0	1	4
Vancomycin VAN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	7,4

Excluded from report (>25% deviations)

Appendix 7b

Staphylococci - summary of results

ANTIMICROBIAL	EURL ST-11.1		EURL ST-11.2		EURL ST-11.3		EURL ST-11.4		EURL ST-11.5		EURL ST-11.6		EURL ST-11.7		EURL ST-11.8	
	Correct	Total	Correct	Total	Correct	Total	Correct	Total	Correct	Total	Correct	Total	Correct	Total	Correct	Total
Cefoxitin FOX	26	26	26	26	26	26	26	26	26	26	26	26	26	26	24	26
Chloramphenicol CHL	26	26	26	26	26	26	25	26	24	25	26	26	26	26	25	26
Ciprofloxacin CIP	26	26	26	26	26	26	26	26	26	26	16	25	26	26	26	26
Clindamycin CLN	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
Erythromycin ERY	27	27	27	27	27	27	27	27	27	27	26	27	27	27	27	27
Gentamicin GEN	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
Linezolid LZD	25	25	23	23	25	25	25	25	25	25	25	25	25	25	25	25
Mupirocin MUP	22	22	22	22	22	22	22	22	22	22	21	22	22	22	22	22
Quinupristin/dalfopristin (Synercid) SYN	24	24	23	24	20	24	24	24	22	23	24	24	24	24	24	24
Sulfamethoxazole SMX	24	25	24	25	24	25	23	24	23	23	24	25	22	25	25	25
Sulfamethoxazole-Trimethoprim SXT	5	5	1	4	1	4	4	4	4	4	3	4	2	4	3	4
Tetracycline TET	26	27	27	27	27	27	26	27	26	26	27	27	27	27	27	27
Tiamulin TIA	24	24	24	24	24	24	23	23	22	22	23	23	23	23	23	23
Trimethoprim TMP	25	26	26	26	26	26	26	26	25	25	26	26	26	26	25	25
Vancomycin VAN	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25

Excluded from the report (≥ 25% deviations)

ANTIMICROBIAL	EURL ST-11.1		EURL ST-11.2		EURL ST-11.3		EURL ST-11.4		EURL ST-11.5		EURL ST-11.6		EURL ST-11.7		EURL ST-11.8	
	Deviation (no.)	Deviation (%)	Deviation (no.)	Deviation (%)	Deviation (no.)	Deviation (%)	Deviation (no.)	Deviation (%)	Deviation (no.)	Deviation (%)	Deviation (no.)	Deviation (%)	Deviation (no.)	Deviation (%)	Deviation (no.)	Deviation (%)
Cefoxitin FOX	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	7,7
Chloramphenicol CHL	0	0	0	0	0	0	1	3,8	1	4	0	0	0	0	1	3,8
Ciprofloxacin CIP	0	0	0	0	0	0	0	0	0	0	9	36	0	0	0	0
Clindamycin CLN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Erythromycin ERY	0	0	0	0	0	0	0	0	0	0	1	3,7	0	0	0	0
Gentamicin GEN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Linezolid LZD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mupirocin MUP	0	0	0	0	0	0	0	0	0	0	1	4,5	0	0	0	0
Quinupristin/dalfopristin (Synercid) SYN	0	0	1	4,2	4	16,7	0	0	1	4,3	0	0	0	0	0	0
Sulfamethoxazole SMX	1	4	1	4	1	4	1	4,2	0	0	1	4	3	12	0	0
Sulfamethoxazole-Trimethoprim SXT	0	0	3	75	3	75	0	0	0	0	1	25	2	50	1	25
Tetracycline TET	1	3,7	0	0	0	0	1	3,7	0	0	0	0	0	0	0	0
Tiamulin TIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trimethoprim TMP	1	3,8	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vancomycin VAN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Excluded from the report (≥ 25% deviations)

Appendix 7c

Escherichia coli **- summary of results**

ANTIMICROBIAL	EURL EC-11.1		EURL EC-11.2		EURL EC-11.3		EURL EC-11.4		EURL EC-11.5		EURL EC-11.6		EURL EC-11.7		EURL EC-11.8	
	Correct	Total	Correct	Total	Correct	Total	Correct	Total	Correct	Total	Correct	Total	Correct	Total	Correct	Total
Ampicillin AMP	31	31	30	31	31	31	30	30	31	31	31	31	31	31	31	31
Azithromycin AZI	30	31	31	31	30	31	30	31	31	31	31	31	29	31	30	31
Cefepime FEP	31	31	na	na	30	31	na	na	31	31	na	na	11	29	31	31
Cefotaxime FOT	62	62	30	31	62	62	31	31	62	62	31	31	62	62	62	62
Cefoxitin FOX	31	31	na	na	31	31	na	na	31	31	na	na	31	31	30	31
Ceftazidime TAZ	62	62	30	31	62	62	31	31	61	61	31	31	62	62	62	62
Chloramphenicol CHL	31	31	31	31	31	31	31	31	31	31	31	31	30	31	19	31
Ciprofloxacin CIP	31	31	31	31	31	31	31	31	31	31	31	31	29	31	30	31
Colistin COL	31	31	31	31	27	30	31	31	31	31	28	31	31	31	31	31
Ertapenem ETP	31	31	na	na	31	31	na	na	31	31	na	na	29	31	30	31
Gentamicin GEN	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31
Imipenem IMI	31	31	na	na	31	31	na	na	30	31	na	na	29	31	26	30
Meropenem MERO	62	62	31	31	61	62	31	31	62	62	31	31	60	62	60	62
Nalidixic acid NAL	31	31	31	31	31	31	31	31	31	31	28	31	30	31	23	30
Sulfamethoxazole SMX	30	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31
Tetracycline TET	31	31	31	31	31	31	31	31	31	31	31	31	29	31	30	31
Tigecycline TGC	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31
Trimethoprim TMP	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31

Excluded from the report (>25% deviations)

ANTIMICROBIAL	EURL EC-11.1		EURL EC-11.2		EURL EC-11.3		EURL EC-11.4		EURL EC-11.5		EURL EC-11.6		EURL EC-11.7		EURL EC-11.8	
	Deviation (no.)	Deviation (%)	Deviation (no.)	Deviation (%)	Deviation (no.)	Deviation (%)	Deviation (no.)	Deviation (%)	Deviation (no.)	Deviation (%)	Deviation (no.)	Deviation (%)	Deviation (no.)	Deviation (%)	Deviation (no.)	Deviation (%)
Ampicillin AMP	0	0	1	3,23	0	0	0	0	0	0	0	0	0	0	0	0
Azithromycin AZI	1	3,23	0	0	1	3,23	1	3,23	0	0	0	0	2	6,45	1	3,23
Cefepime FEP	0	0	na	na	1	3,23	na	na	0	0	0	na	18	62,07	0	0
Cefotaxime FOT	0	0	1	3,23	0	0	0	0	0	0	0	0	0	0	0	0
Cefoxitin FOX	0	0	na	na	0	0	na	na	0	0	0	na	0	0	1	3,23
Ceftazidime TAZ	0	0	1	3,23	0	0	0	0	0	0	0	0	0	0	0	0
Chloramphenicol CHL	0	0	0	0	0	0	0	0	0	0	0	0	1	3,23	12	38,71
Ciprofloxacin CIP	0	0	0	0	0	0	0	0	0	0	0	0	2	6,45	1	3,23
Colistin COL	0	0	0	0	3	10	0	0	0	0	3	9,68	0	0	0	0
Ertapenem ETP	0	0	na	na	0	0	na	na	0	0	0	na	2	6,45	1	3,23
Gentamicin GEN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Imipenem IMI	0	0	na	na	0	0	na	na	1	3,23	0	na	2	6,45	4	13,33
Meropenem MERO	0	0	0	0	1	1,61	0	0	0	0	0	0	2	3,23	2	3,23
Nalidixic acid NAL	0	0	0	0	0	0	0	0	0	0	3	9,68	1	3,23	7	23,33
Sulfamethoxazole SMX	1	3,23	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tetracycline TET	0	0	0	0	0	0	0	0	0	0	0	0	2	6,45	1	3,23
Tigecycline TGC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trimethoprim TMP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Excluded from the report (>25% deviations)

Appendix 8a

Enterococci - deviations

Lab code	Strain ID	Antimicrobial	Read_value	Exp_value	Interp.	Exp_interpr.
2	EURL ENT-11.5	Ampicillin AMP	= 4	= 8	S	R
9	EURL ENT-11.5	Ampicillin AMP	= 4	= 8	S	R
9	EURL ENT-11.8	Chloramphenicol CHL	= 32	= 64	S	R
11	EURL ENT-11.5	Ampicillin AMP	= 2	= 8	S	R
11	EURL ENT-11.8	Chloramphenicol CHL	= 32	= 64	S	R
12	EURL ENT-11.5	Ampicillin AMP	= 4	= 8	S	R
12	EURL ENT-11.8	Chloramphenicol CHL	= 32	= 64	S	R
16	EURL ENT-11.5	Ampicillin AMP	= 4	= 8	S	R
17	EURL ENT-11.7	Ampicillin AMP	= 8	= 4	R	S
20	EURL ENT-11.2	Tigecycline TGC	= 0.5	= 0.25	R	S
20	EURL ENT-11.4	Daptomycin DAP	= 8	= 4	R	S
20	EURL ENT-11.5	Ampicillin AMP	= 4	= 8	S	R
21	EURL ENT-11.3	Linezolid LZD	> 8	= 2	R	S
21	EURL ENT-11.5	Chloramphenicol CHL	> 64	= 8	R	S
21	EURL ENT-11.5	Gentamicin GEN	> 16	<= 8	R	S
21	EURL ENT-11.6	Chloramphenicol CHL	> 64	= 8	R	S
21	EURL ENT-11.6	Quinupristin/dalfopristin (Synercid) SYN	> 4	= 2	R	S
21	EURL ENT-11.7	Chloramphenicol CHL	> 64	= 8	R	S
21	EURL ENT-11.7	Ciprofloxacin CIP	> 8	= 1	R	S
21	EURL ENT-11.7	Erythromycin ERY	> 8	= 2	R	S
21	EURL ENT-11.7	Gentamicin GEN	> 16	<= 8	R	S
21	EURL ENT-11.8	Gentamicin GEN	> 16	<= 8	R	S
21	EURL ENT-11.8	Vancomycin VAN	> 16	= 2	R	S
22	EURL ENT-11.5	Ampicillin AMP	= 4	= 8	S	R
23	EURL ENT-11.5	Ampicillin AMP	= 4	= 8	S	R
23	EURL ENT-11.7	Erythromycin ERY	= 8	= 2	R	S
23	EURL ENT-11.8	Chloramphenicol CHL	= 32	= 64	S	R
25	EURL ENT-11.5	Ampicillin AMP	= 8	= 8	S	R
26	EURL ENT-11.5	Ampicillin AMP	= 4	= 8	S	R
29	EURL ENT-11.5	Ampicillin AMP	4	= 8	S	R
29	EURL ENT-11.8	Chloramphenicol CHL	32	= 64	S	R
30	EURL ENT-11.5	Ampicillin AMP	= 4	= 8	S	R
32	EURL ENT-11.5	Ampicillin AMP	= 4	= 8	S	R
33	EURL ENT-11.8	Chloramphenicol CHL	= 32	= 64	S	R
36	EURL ENT-11.5	Ampicillin AMP	= 4	= 8	S	R
36	EURL ENT-11.8	Chloramphenicol CHL	= 8	= 64	S	R
36	EURL ENT-11.8	Erythromycin ERY	<= 1	> 128	S	R
36	EURL ENT-11.8	Linezolid LZD	= 2	= 16	S	R
36	EURL ENT-11.8	Quinupristin/dalfopristin (Synercid) SYN	= 4	= 16	S	R
36	EURL ENT-11.8	Teicoplanin TEI	= 64	<= 0.5	R	S
36	EURL ENT-11.8	Vancomycin VAN	> 128	= 2	R	S
37	EURL ENT-11.5	Ampicillin AMP	= 4	= 8	S	R
37	EURL ENT-11.8	Chloramphenicol CHL	= 32	= 64	S	R
39	EURL ENT-11.5	Ampicillin AMP	= 4	= 8	S	R
40	EURL ENT-11.5	Ampicillin AMP	= 2	= 8	S	R
40	EURL ENT-11.5	Quinupristin/dalfopristin (Synercid) SYN	= 4	= 8	S	R
40	EURL ENT-11.8	Chloramphenicol CHL	= 32	= 64	S	R
40	EURL ENT-11.8	Erythromycin ERY	> 128	> 128	S	R
42	EURL ENT-11.5	Ampicillin AMP	= 4	= 8	S	R
45	EURL ENT-11.2	Tigecycline TGC	= 0.5	= 0.25	R	S
45	EURL ENT-11.6	Quinupristin/dalfopristin (Synercid) SYN	= 8	= 2	R	S
45	EURL ENT-11.8	Chloramphenicol CHL	= 32	= 64	S	R
45	EURL ENT-11.8	Tigecycline TGC	= 0.5	= 0.25	R	S
56	EURL ENT-11.5	Ampicillin AMP	= 4	= 8	S	R
56	EURL ENT-11.5	Quinupristin/dalfopristin (Synercid) SYN	= 4	= 8	S	R
59	EURL ENT-11.5	Ampicillin AMP	= 4	= 8	S	R
60	EURL ENT-11.5	Ampicillin AMP	= 4	= 8	S	R

Excluded from the report (>25% deviations)

Appendix 8b

Staphylococci - deviations

Lab code	Strain ID	Antimicrobial	Read_value	Exp_value	Interp.	Exp_interpr.
2	EURL ST-11.6	Ciprofloxacin CIP	= 1.0	= 2	S	R
11	EURL ST-11.7	Sulfamethoxazole SMX	> 512.0	<= 64	R	S
12	EURL ST-11.6	Ciprofloxacin CIP	= 1.0	= 2	S	R
12	EURL ST-11.6	Sulfamethoxazole SMX	= 128.0	= 256	S	R
17	EURL ST-11.5	Chloramphenicol CHL	= 8.0	= 8	R	S
18	EURL ST-11.1	Sulfamethoxazole SMX	> 512.0	<= 64	R	S
18	EURL ST-11.2	Sulfamethoxazole SMX	> 512.0	<= 64	R	S
18	EURL ST-11.3	Sulfamethoxazole SMX	> 512.0	<= 64	R	S
18	EURL ST-11.4	Sulfamethoxazole SMX	> 512.0	<= 64	R	S
18	EURL ST-11.7	Sulfamethoxazole SMX	> 512.0	<= 64	R	S
22	EURL ST-11.2	Quinupristin/dalfopristin (Synercid) SYN	= 4.0	= 4	S	R
22	EURL ST-11.3	Quinupristin/dalfopristin (Synercid) SYN	= 2.0	= 2	S	R
22	EURL ST-11.6	Ciprofloxacin CIP	= 1.0	= 2	S	R
23	EURL ST-11.3	Quinupristin/dalfopristin (Synercid) SYN	= 1.0	= 2	S	R
23	EURL ST-11.6	Ciprofloxacin CIP	= 1.0	= 2	S	R
26	EURL ST-11.2	Sulfamethoxazole-Trimethoprim SXT	= 1.0	= 0.5	R	S
26	EURL ST-11.3	Sulfamethoxazole-Trimethoprim SXT	= 2.0	= 0.5	R	S
30	EURL ST-11.6	Ciprofloxacin CIP	= 1.0	= 2	S	R
31	EURL ST-11.2	Sulfamethoxazole-Trimethoprim SXT	> 0.5	= 0.5	R	S
31	EURL ST-11.3	Sulfamethoxazole-Trimethoprim SXT	> 0.5	= 0.5	R	S
31	EURL ST-11.6	Sulfamethoxazole-Trimethoprim SXT	> 0.5	<= 0.25	R	S
31	EURL ST-11.7	Sulfamethoxazole-Trimethoprim SXT	> 0.5	= 0.5	R	S
31	EURL ST-11.8	Sulfamethoxazole-Trimethoprim SXT	> 0.5	<= 0.25	R	S
33	EURL ST-11.2	Sulfamethoxazole-Trimethoprim SXT	= 1.0	= 0.5	R	S
33	EURL ST-11.3	Sulfamethoxazole-Trimethoprim SXT	= 1.0	= 0.5	R	S
33	EURL ST-11.6	Ciprofloxacin CIP	= 0.5	= 2	S	R
33	EURL ST-11.7	Sulfamethoxazole-Trimethoprim SXT	= 1.0	= 0.5	R	S
36	EURL ST-11.6	Ciprofloxacin CIP	= 1.0	= 2	S	R
39	EURL ST-11.4	Chloramphenicol CHL	= 32.0	= 8	R	S
39	EURL ST-11.6	Ciprofloxacin CIP	= 1.0	= 2	S	R
39	EURL ST-11.6	Erythromycin ERY	= 8.0	<= 0.25	R	S
39	EURL ST-11.6	Mupirocin MUP	> 4.0	<= 0.5	R	S
40	EURL ST-11.1	Trimethoprim TMP	> 32.0	<= 2	R	S
40	EURL ST-11.3	Quinupristin/dalfopristin (Synercid) SYN	= 1.0	= 2	S	R
40	EURL ST-11.7	Sulfamethoxazole SMX	> 512.0	<= 64	R	S
42	EURL ST-11.6	Ciprofloxacin CIP	= 1.0	= 2	S	R
45	EURL ST-11.1	Tetracycline TET	= 2.0	<= 0.5	R	S
45	EURL ST-11.4	Tetracycline TET	= 2.0	<= 0.5	R	S
45	EURL ST-11.5	Quinupristin/dalfopristin (Synercid) SYN	= 4.0	= 1	R	S
45	EURL ST-11.8	Cefoxitin FOX	= 8.0	= 4	R	S
59	EURL ST-11.3	Quinupristin/dalfopristin (Synercid) SYN	= 2.0	= 2	S	R
59	EURL ST-11.8	Cefoxitin FOX	= 8.0	= 4	R	S
59	EURL ST-11.8	Chloramphenicol CHL	= 8.0	= 8	R	S

Excluded from the report (≥ 25% deviations)

Appendix 8c

Escherichia coli **- deviations**

Lab code	Strain ID	Antimicrobial	Read_value	Exp_value	Interp.	Exp_interpr.
2	EURL EC-11.3	Colistin COL	2	4	S	R
2	EURL EC-11.8	Chloramphenicol CHL	32	16	R	S
4	EURL EC-11.7	Cefepime FEP	1	0,12	R	S
4	EURL EC-11.7	Ciprofloxacin CIP	0,5	0,03	R	S
4	EURL EC-11.7	Tetracycline TET	16	4	R	S
4	EURL EC-11.8	Chloramphenicol CHL	32	16	R	S
6	EURL EC-11.7	Cefepime FEP	0,25	0,12	R	S
6	EURL EC-11.8	Chloramphenicol CHL	32	16	R	S
12	EURL EC-11.7	Cefepime FEP	0,25	0,12	R	S
12	EURL EC-11.8	Chloramphenicol CHL	32	16	R	S
16	EURL EC-11.8	Chloramphenicol CHL	32	16	R	S
17	EURL EC-11.3	Azithromycin AZI	16	8	R	S
17	EURL EC-11.3	Cefepime FEP	2	2	S	R
17	EURL EC-11.7	Cefepime FEP	0,5	0,12	R	S
17	EURL EC-11.8	Chloramphenicol CHL	32	16	R	S
18	EURL EC-11.7	Cefepime FEP	0,5	0,12	R	S
19	EURL EC-11.8	Chloramphenicol CHL	32	16	R	S
19	EURL EC-11.8	Nalidixic acid NAL	16	32	S	R
20	EURL EC-11.3	Colistin COL	2	4	S	R
20	EURL EC-11.8	Imipenem IMI	0,5	2	S	R
20	EURL EC-11.8	Nalidixic acid NAL	16	32	S	R
21	EURL EC-11.8	Nalidixic acid NAL	16	32	S	R
22	EURL EC-11.2	Ampicillin AMP	> 64	4	R	S
22	EURL EC-11.2	Cefotaxime FOT	> 4	<= 0.25	R	S
22	EURL EC-11.2	Ceftazidime TAZ	4	<= 0.5	R	S
22	EURL EC-11.7	Cefepime FEP	0,25	0,12	R	S
23	EURL EC-11.7	Cefepime FEP	0,25	0,12	R	S
25	EURL EC-11.7	Cefepime FEP	0,25	0,12	R	S
25	EURL EC-11.8	Chloramphenicol CHL	32	16	R	S
26	EURL EC-11.1	Sulfamethoxazole SMX	128	<= 8	R	S
26	EURL EC-11.3	Colistin COL	2	4	S	R
26	EURL EC-11.4	Azithromycin AZI	8	64	S	R
26	EURL EC-11.5	Imipenem IMI	0,25	4	S	R
26	EURL EC-11.6	Colistin COL	2	4	S	R
26	EURL EC-11.7	Azithromycin AZI	16	> 64	S	R
26	EURL EC-11.7	Cefepime FEP	0,5	0,12	R	S
26	EURL EC-11.7	Ertapenem ETP	0,12	0,03	R	S
26	EURL EC-11.7	Imipenem IMI	1	<= 0.12	R	S
26	EURL EC-11.8	Imipenem IMI	0,5	2	S	R
26	EURL EC-11.8	Nalidixic acid NAL	16	32	S	R
29	EURL EC-11.7	Cefepime FEP	0,25	0,12	R	S
30	EURL EC-11.7	Cefepime FEP	0,25	0,12	R	S
32	EURL EC-11.8	Nalidixic acid NAL	16	32	S	R
33	EURL EC-11.7	Cefepime FEP	0,25	0,12	R	S
33	EURL EC-11.8	Chloramphenicol CHL	32	16	R	S
34	EURL EC-11.8	Chloramphenicol CHL	32	16	R	S
36	EURL EC-11.7	Cefepime FEP	0,25	0,12	R	S
36	EURL EC-11.8	Chloramphenicol CHL	32	16	R	S
37	EURL EC-11.3	Meropenem MERO	<= 0.03	<= 0.03	R	S

37	EURL EC-11.6	Nalidixic acid NAL	32	16	R	S
39	EURL EC-11.6	Colistin COL	2	4	S	R
39	EURL EC-11.7	Cefepime FEP	0,25	0,12	R	S
39	EURL EC-11.8	Chloramphenicol CHL	32	16	R	S
39	EURL EC-11.8	Imipenem IMI	0,5	2	S	R
40	EURL EC-11.6	Nalidixic acid NAL	32	16	R	S
40	EURL EC-11.7	Cefepime FEP	0,25	0,12	R	S
42	EURL EC-11.7	Azithromycin AZI	8	> 64	S	R
42	EURL EC-11.7	Cefepime FEP	4	0,12	R	S
42	EURL EC-11.7	Chloramphenicol CHL	32	16	R	S
42	EURL EC-11.7	Ciprofloxacin CIP	1	0,03	R	S
42	EURL EC-11.7	Ertapenem ETP	1	0,03	R	S
42	EURL EC-11.7	Imipenem IMI	1	<= 0.12	R	S
42	EURL EC-11.7	Meropenem MERO	1	<= 0.03	R	S
42	EURL EC-11.7	Meropenem MERO	1	<= 0.03	R	S
42	EURL EC-11.7	Nalidixic acid NAL	32	<= 4	R	S
42	EURL EC-11.7	Tetracycline TET	> 64	4	R	S
42	EURL EC-11.8	Azithromycin AZI	> 64	8	R	S
42	EURL EC-11.8	Ciprofloxacin CIP	0,03	1	S	R
42	EURL EC-11.8	Ertapenem ETP	0,03	2	S	R
42	EURL EC-11.8	Imipenem IMI	<= 0.12	2	S	R
42	EURL EC-11.8	Meropenem MERO	<= 0.03	1	S	R
42	EURL EC-11.8	Meropenem MERO	<= 0.03	2	S	R
42	EURL EC-11.8	Nalidixic acid NAL	<= 4	32	S	R
42	EURL EC-11.8	Tetracycline TET	4	> 64	S	R
45	EURL EC-11.6	Colistin COL	2	4	S	R
45	EURL EC-11.6	Nalidixic acid NAL	32	16	R	S
45	EURL EC-11.7	Cefepime FEP	0,25	0,12	R	S
45	EURL EC-11.8	Nalidixic acid NAL	16	32	S	R
56	EURL EC-11.8	Cefoxitin FOX	8	16	S	R
59	EURL EC-11.1	Azithromycin AZI	32	16	R	S
60	EURL EC-11.7	Cefepime FEP	0,25	0,12	R	S

Excluded from the report (>25% deviations)

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